ProScan III
Universal Microscope Automation Controller

Manual Version 1.04

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Section 1 Important Safety Information

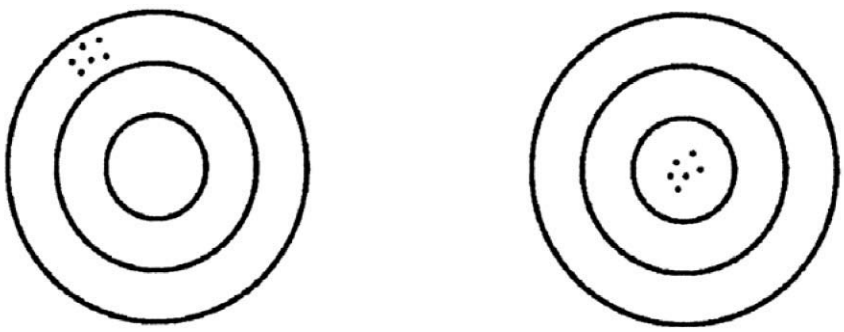
1.1 Important Safety Information

- Save this manual as it contains important safety information and operating instructions.
- Use only as specified by these operating instructions or the intrinsic protection provided by the unit may be impaired.
- Before using the stage system, please follow and adhere to all warnings, safety and operating instructions located on the product and in this User Manual.
- It is safe for use in an ambient temperature from 5 to 40°C with relative humidity to 80% up to 31°C decreasing linearly to 50%rH at 40°C.
- **Do not** expose the product to water or moisture while energised.
- **Do not** expose the product to extreme hot or cold temperatures.
- **Do not** expose the product to open flames.
- **Do not** allow objects to fall on or liquids to spill on the product.
- **Do not** replace detachable mains supply cords by inadequately rated cords.
- Connect the AC power cord only to designated power sources as marked on the product.
- Make sure the electrical cord is located so that it will not be subject to damage.
- Make sure the system in installed so that the front panel power switch is easily accessible.
- For use in a manner not specified in this manual contact Prior before any work is done.
- To reduce the risk of damage, unplug the product from the power source before connecting the components together.
- **DANGER** - never alter the AC cord or plug. If the plug will not fit into the outlet, have a proper outlet installed by a qualified electrician.
- Only suitably rated and approved mains cord-sets should be used as per the country of use.
- Use only the proper type of power supply cord set (provided with the system) for this unit.
- The ProScan III is class 1 and must be only connected to a power outlet which provides a protective earth (ground).
- **Do not** attempt to disassemble the product. Doing so will void the warranty. This product does not contain consumer serviceable components. Service should be performed by Authorised Service Centres.
- Only the exterior of this product should be cleaned using a damp lint-free cloth.
- This warning symbol indicates that there is a high voltage danger.

Section 2 Repeatability and Accuracy Explained

2.1 Repeatability and Accuracy

Metric Accuracy, Repeatability and Resolution are important considerations when evaluating stage performance. Metric Accuracy is simply defined as the difference between the requested and the actual motion performed by a linear motion device. Repeatability is defined as the ability of a device to reproduce to a given position. Resolution is then defined as the smallest movement or step size the device is capable of. Note: The resolution of the X and Y axes are usually different from that of the Z axis or focus resolution. The Marksman Analogy shown below attempts to pictorially demonstrate the difference between metric accuracy and repeatability. The target on the left shows a cluster of shots that are all in the same basic location, yet not in the desired location (the centre of the target). The marksman was repeatable, but not accurate. The target on the right has all of the shots close together and at the centre of the target. The marksman that took these shots is both accurate and repeatable. Some motorized stage manufacturers overstate their stage accuracy by using the Root



Mean Square (RMS) definition of accuracy. Prior Scientific uses the Standard Deviation Method. When Prior Scientific quotes stage accuracy, 3 sigma accuracy (+/- 3 Standard Deviations) is used. This means that 99.74% of all movements made by our stage will be within our stated accuracy or repeatability range. The following example compares RMS and 3 Sigma Accuracy. Consider a stage at the 'Home' position which is 1 micron in the X axis away from the stage zero position. The stage can be cycled through a series of moves which take the stage away from 'Home' and then return to 'Home' at which point the actual position in the X axis is measured. After 14 cycles, the following data may be collected; 1.8, 1.5, 0.1, 1.7, 1.8, 1.1, 1.8, 0.9, 1.8, 2.0, 0.0, 1.5, 0.9, 1.8. The 3 sigma accuracy for these moves is +/-1.0 microns, while the RMS accuracy is +\-0.7 microns! The stage can be shown mathematically to have 2 different accuracies. However, the data shows that 1/2 of the measured values fall outside the 0.7 RMS accuracy range, while all the data fall within the 3 Sigma accuracy range. Calculating accuracy using the RMS method exaggerates the accuracy of a stage.

2.2 Step Motors and Resolution

The Prior ProScan stages and focus drives use high precision step motors. Generally, the step motors used in Prior stages products are either 1.8 degree (200 steps per revolution) motors or 0.9 degree (400 steps per revolution). The ProScan controllers provide a bipolar chopper drive to the motors which allow for maximum torque, stabilization, smoothness, and performance. As a simple example the motors receive pulses from the controller which in turn causes them to rotate. Theoretically if the motors are operated in a "full step" mode, one pulse from the controller will rotate the motor 1.8 degrees or 1/200 of a revolution (1/400 for the 0.9 degree motors). The example below uses the 0.9 degree motor, it is applicable to both motors. The ProScan controller microstep the motors, this is a technique whereby the coil current in the motor is precisely controlled to sub-divide the fundamental step angle (0.9 degrees) of the motor into a series of smaller sub-steps called microsteps or pulses. The ProScan controller is capable of creating 250 microsteps per full step of the motor.

Thus, for a focus motor (1.8 degree motor) attached to a microscope that has a fine focus mechanism with 100 µm per revolution of the fine focus shaft, the system can achieve the following resolution: (200 step/rev) x (250 micro-steps/step) = 50,000 micro-steps/rev Hence, (100 µm/rev) / (50,000 micro-steps/rev) = 0.002 µm/micro-step Therefore, the theoretical resolution of the focus drive motor is 0.002 µm/pulse.

For a typical stage (0.9 degree motor) with a 1mm pitch screw (1mm per rev or 1000 µm per rev), the stage has a resolution as shown below: (400 step/rev) x (250 micro-steps/step) = 100,000 micro-steps/rev Hence, (1000 µm/rev) / (100,000 micro-steps/rev) = 0.01 µm/micro-step

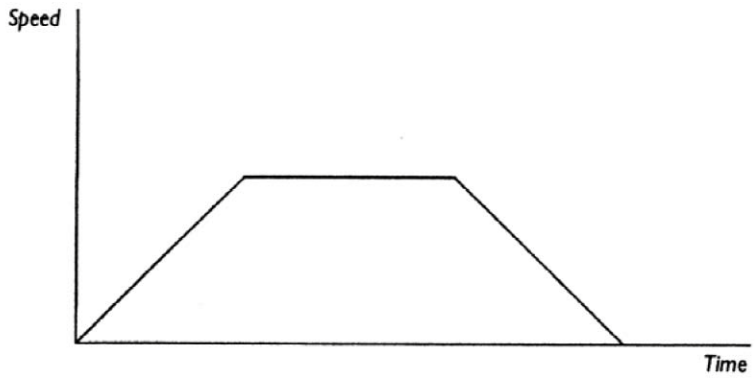
For a typical stage (1.8 degree motor) with a 2mm pitch screw (2mm per rev or 2000 µm per rev), the stage has a resolution as shown below: (200 step/rev) x (250 micro-steps/step) = 50,000 micro-steps/rev Hence, (2000 µm/rev) / (50,000 micro-steps/rev) = 0.04 µm/micro-step

For a typical stage (1.8 degree motor) with a 5mm pitch screw (5mm per rev or 5000 µm per rev), the stage has a resolution as shown below:

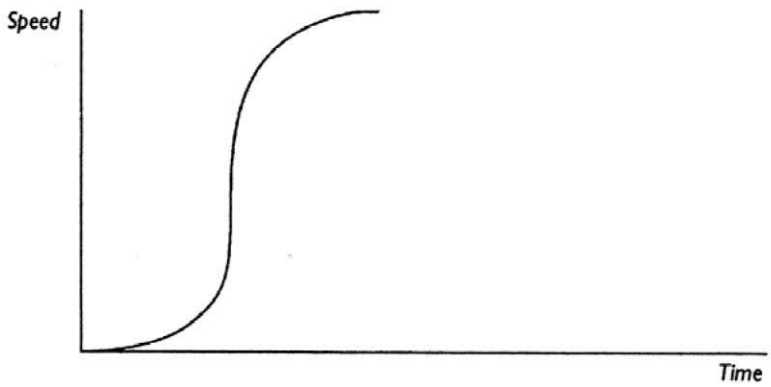
(200 step/rev) x (250 micro-steps/step) = 50,000 micro-steps/rev
Hence, (5000 µm/rev) / (50,000 micro-steps/rev) = 0.1 µm/micro-step

2.3 S curve vs. Trapezoidal Accelerations

Step motors for years have been accelerated with a standard trapezoidal acceleration. An example of a trapezoidal acceleration is shown below: This method of motor acceleration has a great impact on the performance of the system.



The trapezoidal acceleration causes the stage to jerk as it starts, switches from acceleration mode to maximum velocity mode, and switches from maximum velocity mode to deceleration mode. (Note all of the sharp corners on the graph). This can cause the stage to vibrate and it can increase stage settling time.
The ProScan controller accelerates the stage via the S-curve as shown below:
The S-curve acceleration transitions from starts to stops with smooth accelerations and



decelerations thereby resulting in faster, quiet, and vibration free performance. The stage can actually be moved faster due to the ramp characteristics of the S-curve. Settling time is greatly reduced and overall stage performance is enhanced.

2.4 IST and Stage Mapping

IST is a system where the stage movement is analysed during the production process and errors in metric accuracy recorded. Metric errors in stages tend to be linear in form, so the metric error is mapped to a straight line. The description of the straight line, the gradient and offset is stored on a chip on the stage itself. This is done for both axes creating four numbers, hence the common description 4 point mapping. Prior products are Plug and Play, i.e., any product can be attached to any controller and the information about the stage is loaded into the controller. This makes Prior systems very flexible, and easy to set up.

Stage Mapping takes the IST one step further and does not assume that any errors in the stage are linear. The mapping is in 1mm square grid pattern, i.e., it generates 4 numbers for each 1mm square of the stage. The significantly enhances metric accuracy.

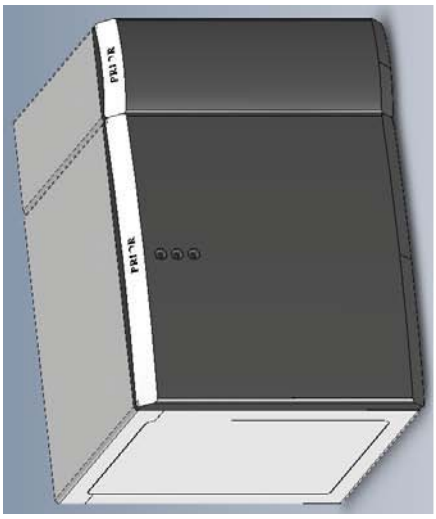
Section 3 Identifying and connecting your system

3.1 Identifying the parts of the ProScan III controller

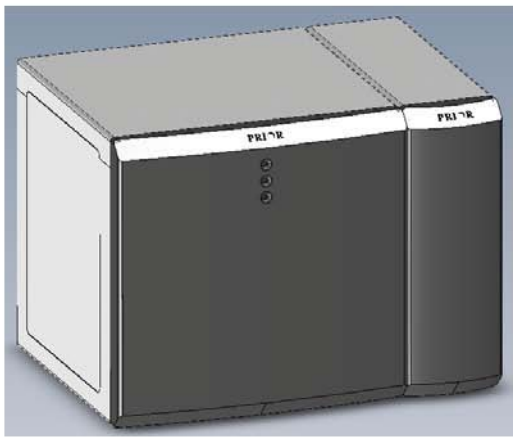
The controller consists of:
1 off, controller box.
1 off, RS232 Cable.
1 off, USB cable.
1 off Power cable, supplied suitable for you geographical area.

The controller box may be of two variants, the vertical stack option or the horizontal stacking options, for the purposes of this manual we will use the horizontal version in pictures and instruction below, however the instructions apply equally to the vertical version.

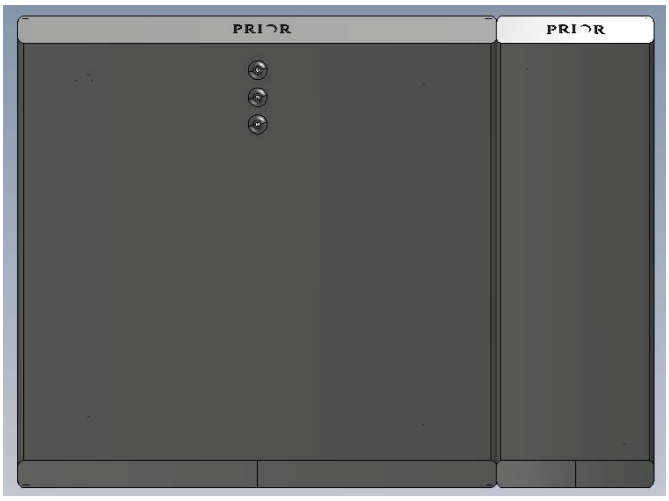
Vertical Option



Horizontal Option

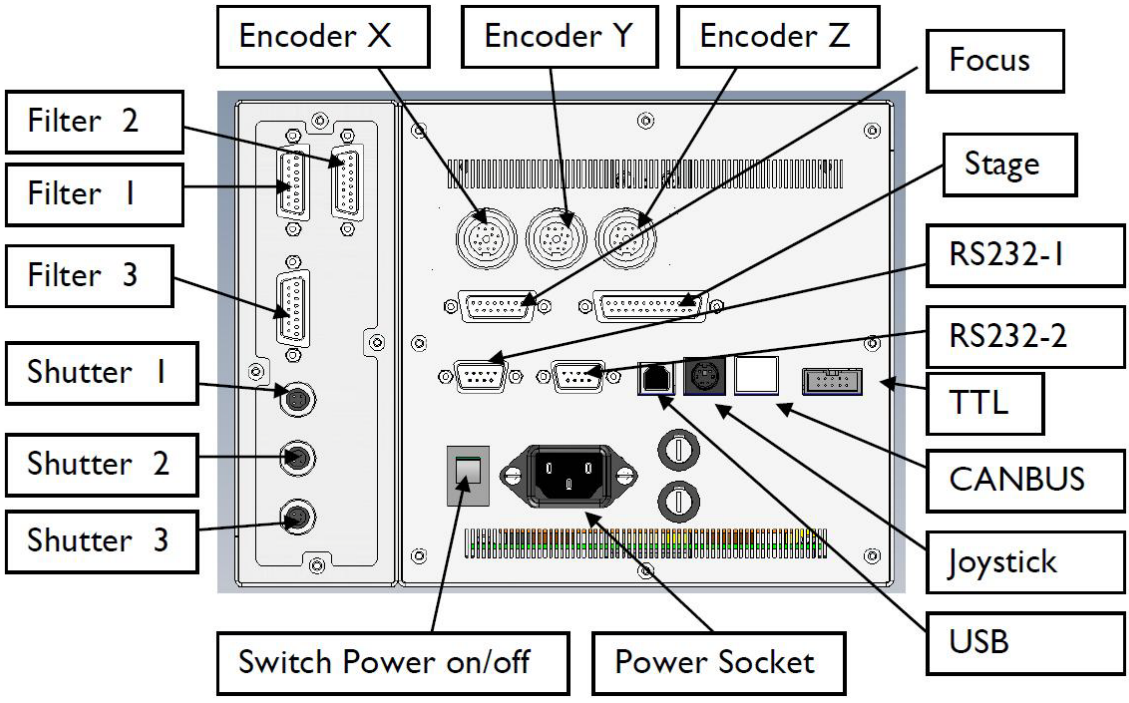


3.2 ProScan III controller box connections and indicators



The controller front face has 3 LED.
1. POWER: Green Illumined: Power On
2. TX RX: Two Colour LED, RX receive and TX transmit communications
a. RX Amber illuminated
b. TX Green illuminated
3. STATUS: Red illuminated: Fault in system.

The rear of the controller has the connections to accessories, communications and power.



3.3 Installing accessories.

All the connectors are labelled, when plugging and unplugging connector always turn the power off.

3.31 Installing stages

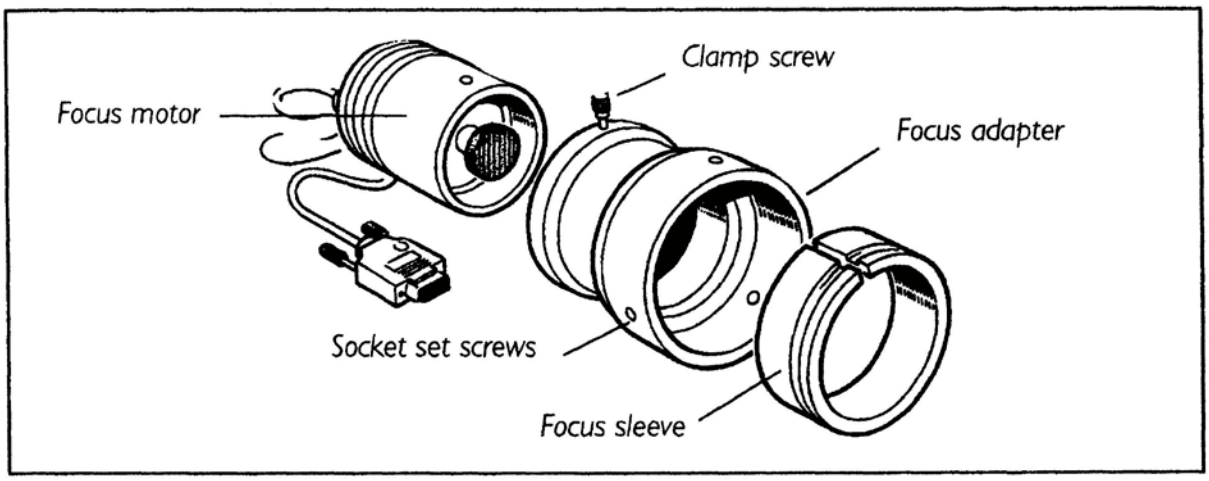
All stages connect to the 25way connector labelled "STAGE". Switch off the power using the power switch. Connect and firmly and screw in the cable both at the controller and stage.

If you have an encoded stage, plug and screw in the encoder cables, these are labelled X and Y, ensure the X cable is plugged into the connector on the ProScan III labelled X. Ensure the Y cable is plugged into the connector on the ProScan III labelled Y.

Power on the ProScan III, the ProScan III will now auto detect the stage and setup the features associated with that stage in software.

3.32 Installing focus

All focus systems connect to the 15way connector labelled "FOCUS". Switch off the power using the power switch. Connect and firmly and screw in the cable to the controller.



The general installation procedure is below, for specialised systems see the appendices.

The following instructions refer to the standard split sleeve mounting.

1. Loosen the clamp screw on the focus motor assembly and remove the focus motor from the focus adapter.
2. Loosen the 3 socket set screws around the periphery of the focus adapter using a 2mm Allen wrench until the focus sleeve is able to fit inside the adapter. Note that it is important to insert the sleeve in the correct orientation with the lip furthest inside the adapter (the chamfered edge of the sleeve will be inserted first). Note the orientation of the sleeve as it has a recess around its outer surface, which will hold the sleeve in when the setscrews are tightened. This recess must line up with the tips of the socket set screws.
3. With the sleeve in place, tighten the 3 socket set screws in sequence until they all just touch the sleeve, ensuring that the split in the sleeve does not line up with any of the set screw positions. DO NOT TIGHTEN UP ANY OF THE SETSCREWS AT THIS STAGE.
4. Push the adapter onto the preferred coarse knob of the microscope as far as it will go.
5. The inside fitting diameter of the sleeve is designed to be slightly larger than the coarse knob, provided the setscrews have not been tightened and are compressing the sleeve.
6. While holding the adapter in place, tighten the set screws in sequence only enough to secure the unit onto the coarse focus knob. The focus knob will have to be rotated to gain access to all of the screws.
7. Check that the unit has been tightened sufficiently by taking hold of it and turning it. If the adapter is correctly fitted it will stay attached to the coarse knob.
8. Slide the focus motor into the adapter as far as it will go and while applying gentle pressure to the motor tighten the clamp screw. This will hold the motor in place.
   The rubber drive bush on the end of the motor spindle should now be pressing against the

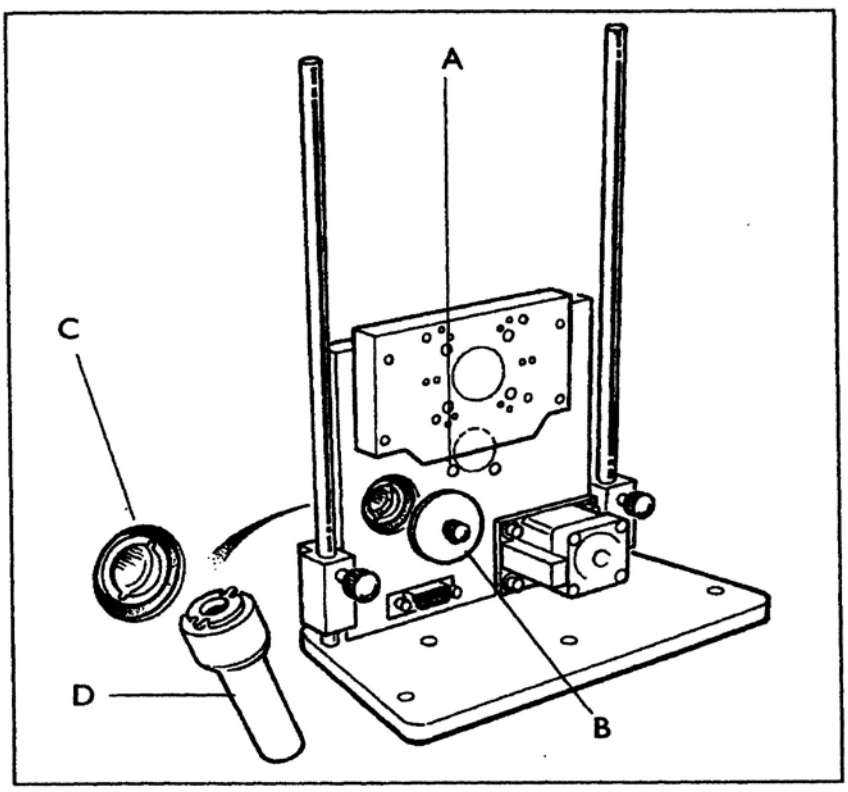
end surface of the fine focus control knob. This can be confirmed by manually rotating the exposed fine focus knob on the opposite side of the microscope and feeling for the resistance caused by the detent positions of the stepper motor as it rotates. This will not cause any damage to the focus motor.

9. Confirm that the controller is switched off before connecting the 15 way D type plug on the focus motor lead to the socket on the rear of the controller as shown on page 10.

On power up the system auto detects the focus motor and the controller configures the system to drive the focus motor in the correct direction when mounted to the right hand side of an upright microscope. If the left hand coarse control knob is preferred by the user or the focus drive is to be mounted on an inverted microscope, the motor direction can be reversed either in the Interactive Control Centre settings menu or by using a PC with a terminal emulation program e.g. HyperTerminal and changing the settings of the ZD command via RS232 (USB) communication.

3.32 Installing filter wheels and shutters

It is recommended that filters be installed before mounting the filter wheel to a microscope.



1 Select filter position required for loading, by checking the number displayed in the load position indicator window (A)

2 Remove the magnetic covers (B) from the load port.

3 Remove lock ring (C) by unscrewing from the filter holder cell with the tool (D) provided.

4 Insert desired filter and replace lock ring.

5 Repeat this process for all the desired filter positions.
6 Replace magnetic covers.

All Filter wheels connect to the 15way connector, it can be labelled “FILTER” or “AXIS A”, you can select FILTER 1, FILTER 2 or Axis A.

Switch off the power using the power switch.
Connect and firmly and screw in the cable both at the controller and Filter wheel.

All shutters connect to the round connector labelled “S”, you can select S1, S2 or S3.
Switch off the power using the power switch.
Connect and firmly and screw in the cable to the controller.

Prior Filter Wheels and Shutters are supplied with the correct adapter flanges fitted, for the specified microscope stand. Therefore the mounting of this equipment uses exactly the same procedure used when fitting the microscopes lamphouse. All Prior Filter Wheels and Shutters are manufactured with C mount threads. The addition of a male to male C mount adapter (Part No. HF207) allows these units to be mounted to a microscope camera port, if required.

Note: Shutter should always be installed with the silvered face facing the lamphouse.

3.33 Fourth Axis or Auxiliary Axis equipment.

Fourth Axis or Auxiliary Axis equipment connects to the 15way connector, labelled “AXIS A”. Switch off the power using the power switch. Connect and firmly and screw in the cable both at the controller and the equipment.

The controller will automatically detect Prior accessories and set them up for use. For non-standard user equipment use the FOURTH commands in the ASCII commands section.

3.34 Connecting the Interactive Control Centre.

Ensure the system is switched off. Plug in the 9 way connector to either the RS232-1 (if this is not available use the RS232-2 connector). Power on the system. The Interactive Control Centre will detect the ProScan III controller and automatically configure the internal software. See the Interactive Control Centre manual for further details.

3.35 Installing a Lumen 200Pro

The Lumen 200Pro uses 2 15way connectors and a round “shutter” connector, the two 15way connectors should be connected to “FILTER 1” and “FILTER 2”, if necessary use “AXIS A”.

Switch off the power using the power switch.
Connect and firmly and screw in the cables for both at the controller and two Lumen 15 way

connectors.

The shutter connector is optional and should be connected to the ProScan III “S1, S2 or S3”.
Switch off the power using the power switch.
Connect and firmly and screw in the cable both at the controller and Lumen 200Pro connector.

Note: If connected the default for the Lumen200 Pro is OFF, the system must be activated via software.

3.4 Other Accessories.

Model Number	**Description**
PS3J100	Interactive Control Centre for ProScan III
L200	Fluorescence Light Source
L200Pro	Fluorescence Light Source with inclusive Filter wheel and light attenuator
NZ100	NanoScanZ Piezo stage for H117 stages
NZ200	NanoScanZ Piezo stage for H117 stages
NZ250	NanoScanZ Piezo stage for H117 stages Large format for micro titre plates
NZ500	NanoScanZ Piezo stage for H117 stages Large format for micro titre plates
H101A	Stage for upright microscopes
HF110A	Fast 10 position filter wheel for 25mm filters
HF108A	Fast 8 position filter wheel for 32mm filters
H122KLC	Solid Couple Adapter for Focus Drive on Leica
H122KON	Solid Couple Adapter for Focus Drive on Olympus/Nikon
HF200	High Speed Shutter, 25mm aperture for use when mounting to filter wheel
HF202	High Speed Shutter, 25mm aperture (for stand alone use)
HF201	High Speed Shutter, 32mm aperture for use when mounting to filter wheel
HF204	High Speed Shutter, 32mm aperture (for stand alone use)

3.5 Expanding the ProScan III.

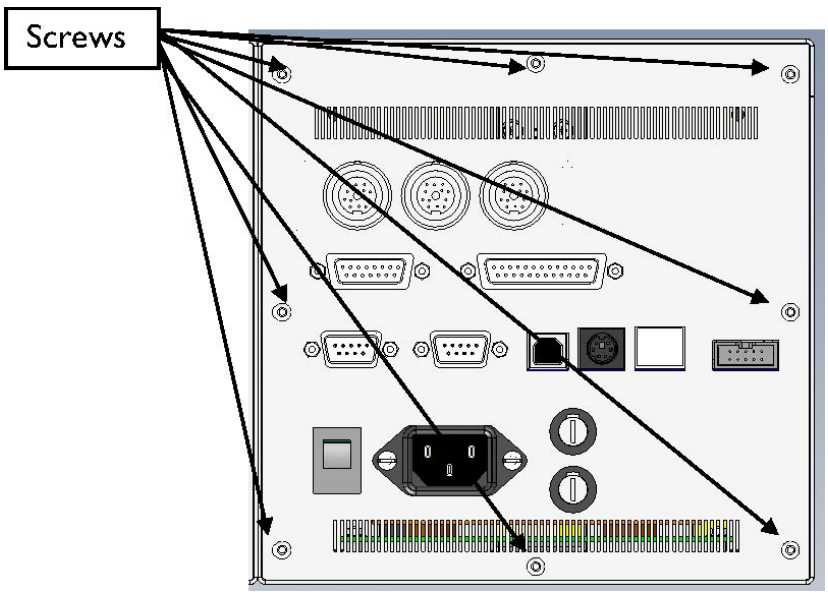
Note: The following instructions should only be followed by either; a Prior trained and authorized personnel, or a qualified electrical engineer.

Caution: Disconnect all power supplies before starting this procedure.

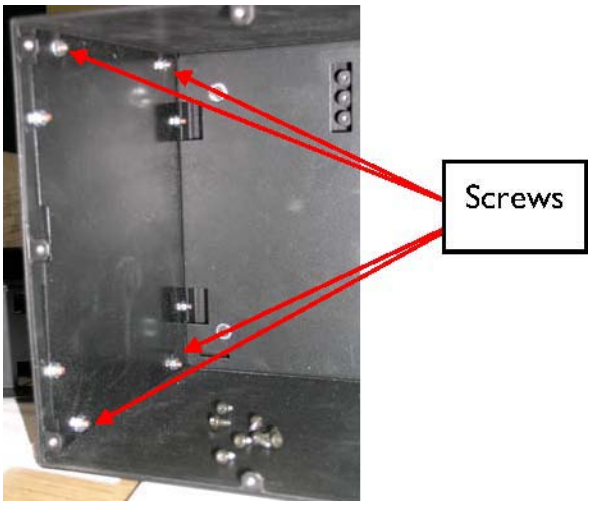
The ProScan III can be expanded by adding an ancillary box. For instance: An H31XYZ main box can have a Filter controller added to create an H31XYZF An H31F main box can have a XYZ controller added to create an H31XYZF. The system can control up to 15 axes, for other combinations please consult with your local Prior Sales contact.

3.5.1 Adding an ancillary box.

Disconnect all cables from the controller box. Unscrew and remove the 8 screws on the back of the unit, keep these screws in a safe place.

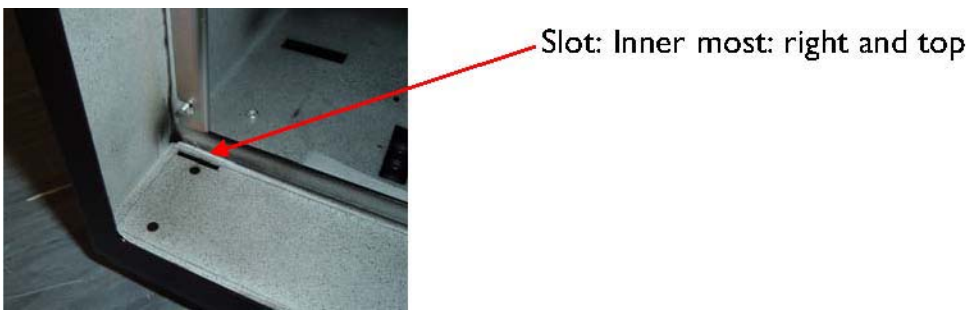


Gently pull the back panel out of the box, you may need to place the back of the unit onto a flat surface, then pull the case up leaving the back panel boards and LED's on the flat surface.



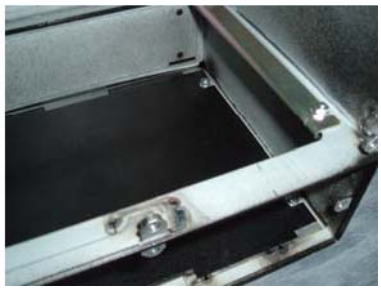
Select the side (horizontal versions) top/bottom (vertical versions) panel you wish to remove. Remove the side panel in the box by removing the 4 nuts.

Orientation of the ancillary box and the cube.
To install the ancillary box on the right or on top of the cube ensure the slot indicated blow are inner most to the cube.
To install the ancillary box on the left or underneath the cube ensure the slots indicated below are outermost from the cube.

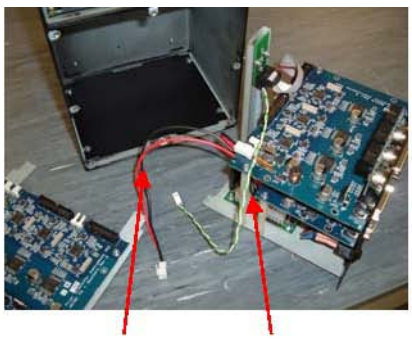


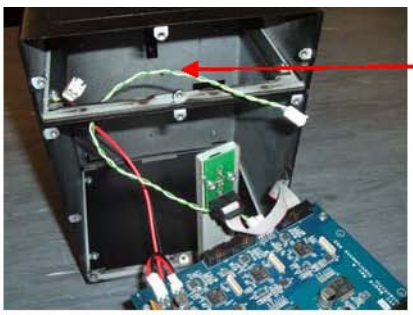
Fix the ancillary box to the main box using the U-clamps provided.

Take the panel you have removed and fix it into place on the ancillary box with the screws provided. To gain access to fit the panel, remove the screws on the back of the ancillary box and withdraw the board and back plate.

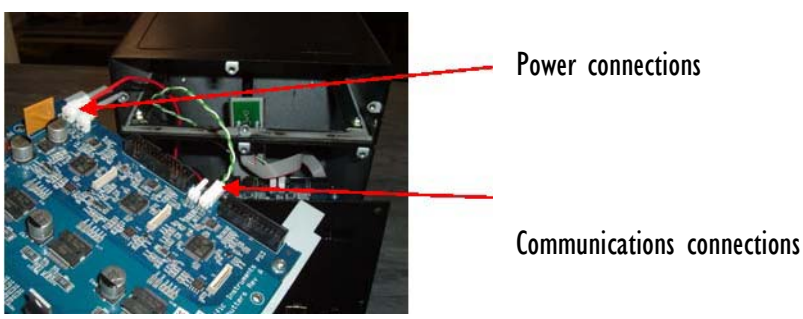


Lay the ancillary box board and the main box board next to the box system.





Connect the Power (red and black cable) from the power supply under the two boards, (this may be cable tied to the supporting pillars). Ensure the cables pass though the opening between the cube and the ancillary box.
Connect the communications (white and pick) cable, as indicated



Push the main unit back into the box and fix in place with the eight screws.

Push the ancillary unit board back into place and fix with the 4 screws.

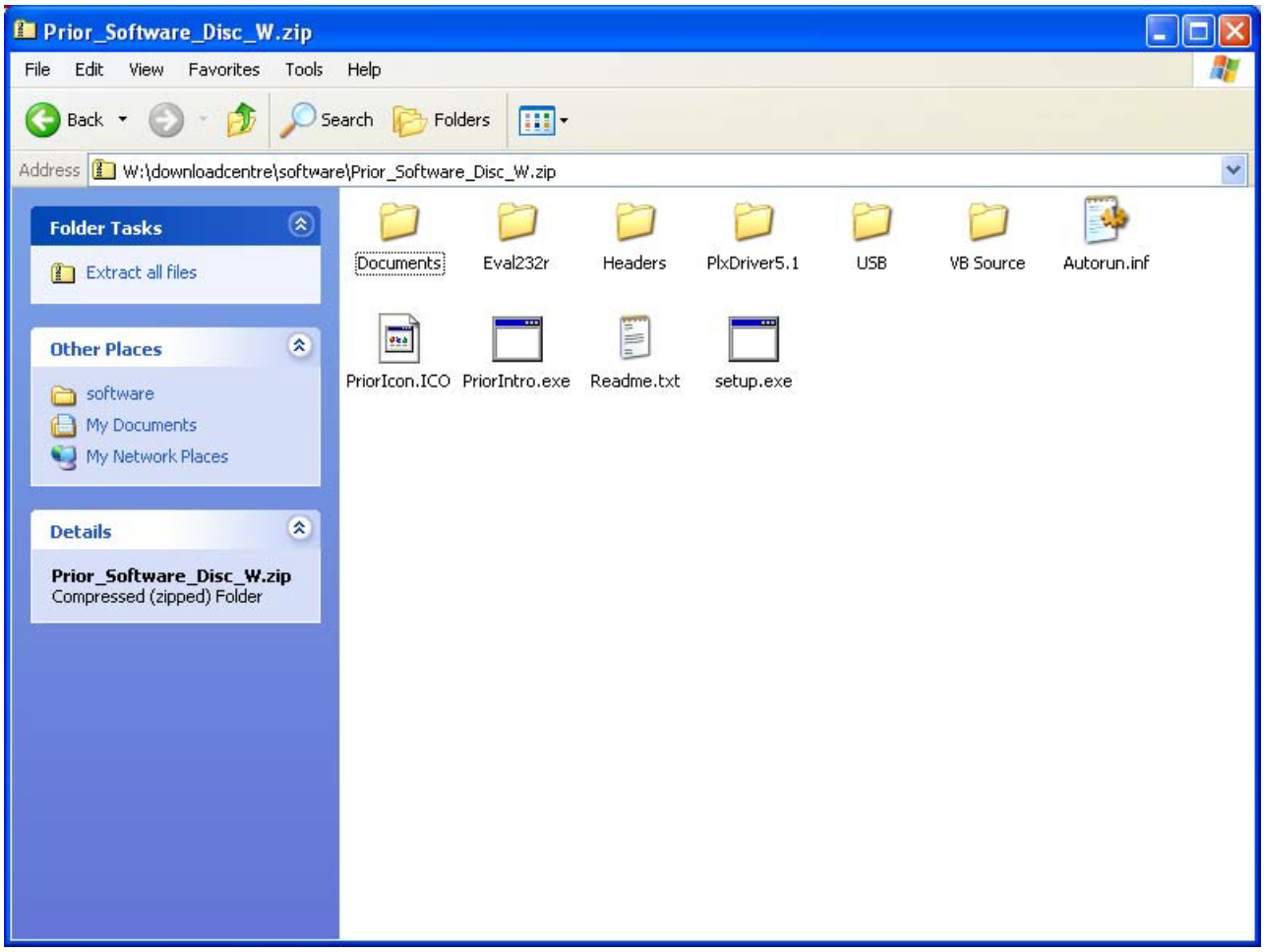
The unit is now ready to use.

Section 4 Installing and Using the Software

4.1 Installing Software.

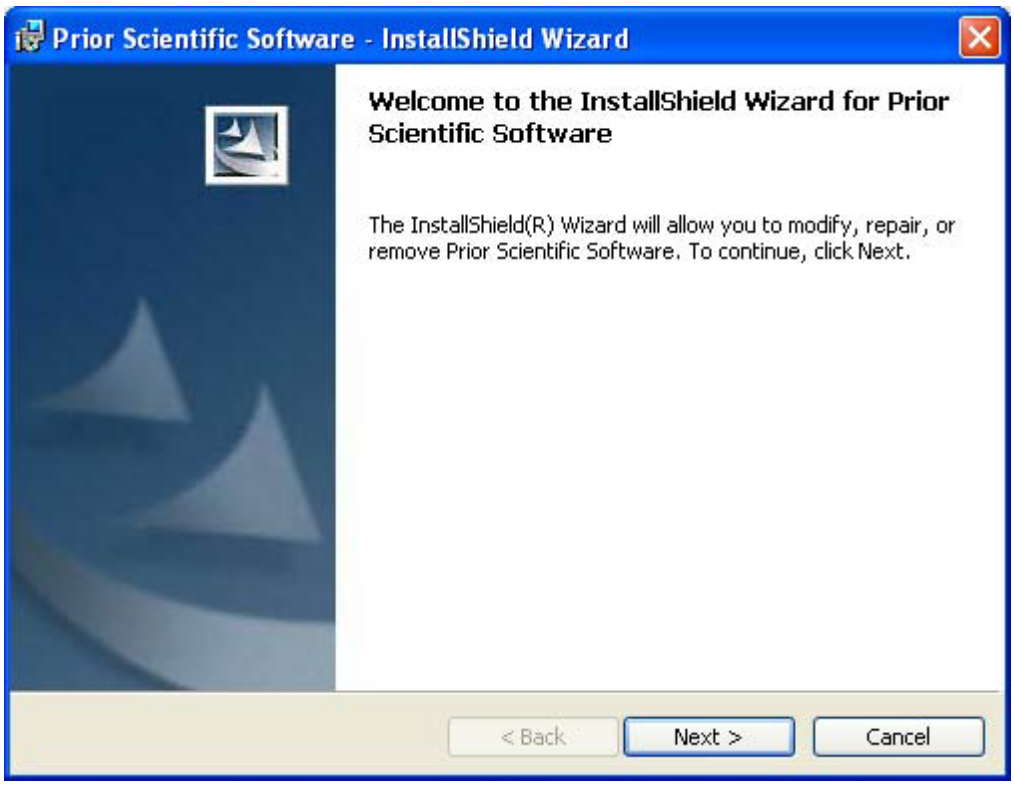
4.1.1 Installing the Prior Freeware

Download the freeware CD from the Prior Website www.prior.com

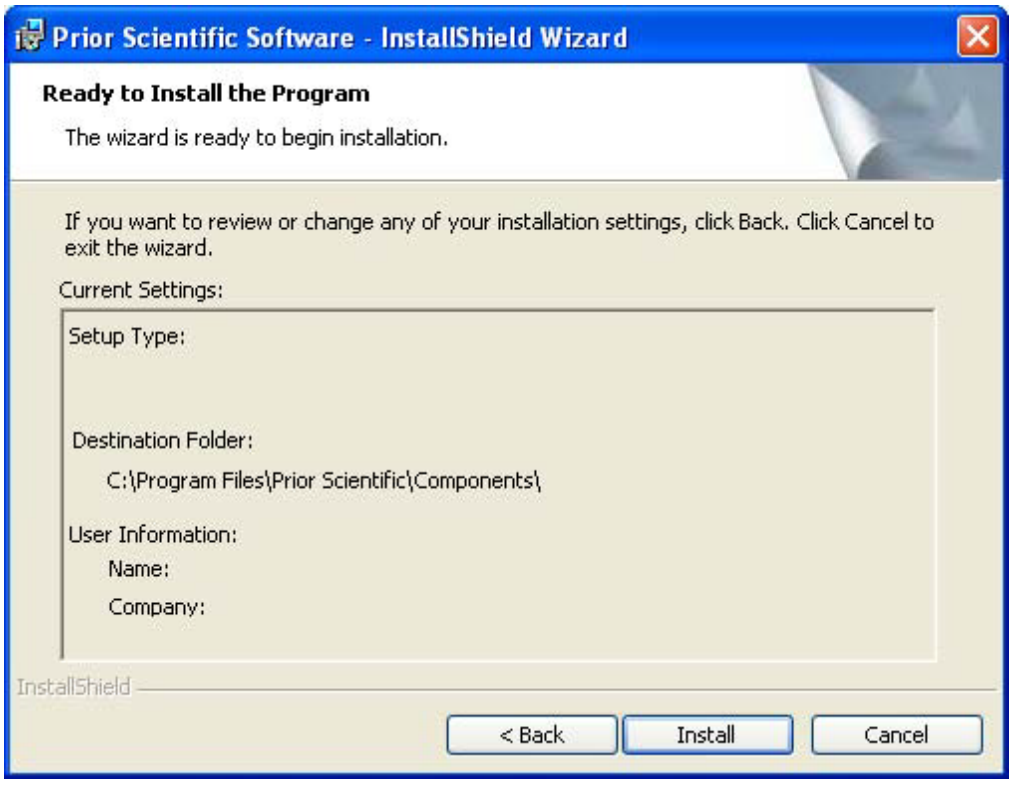


Content of the Zip file.

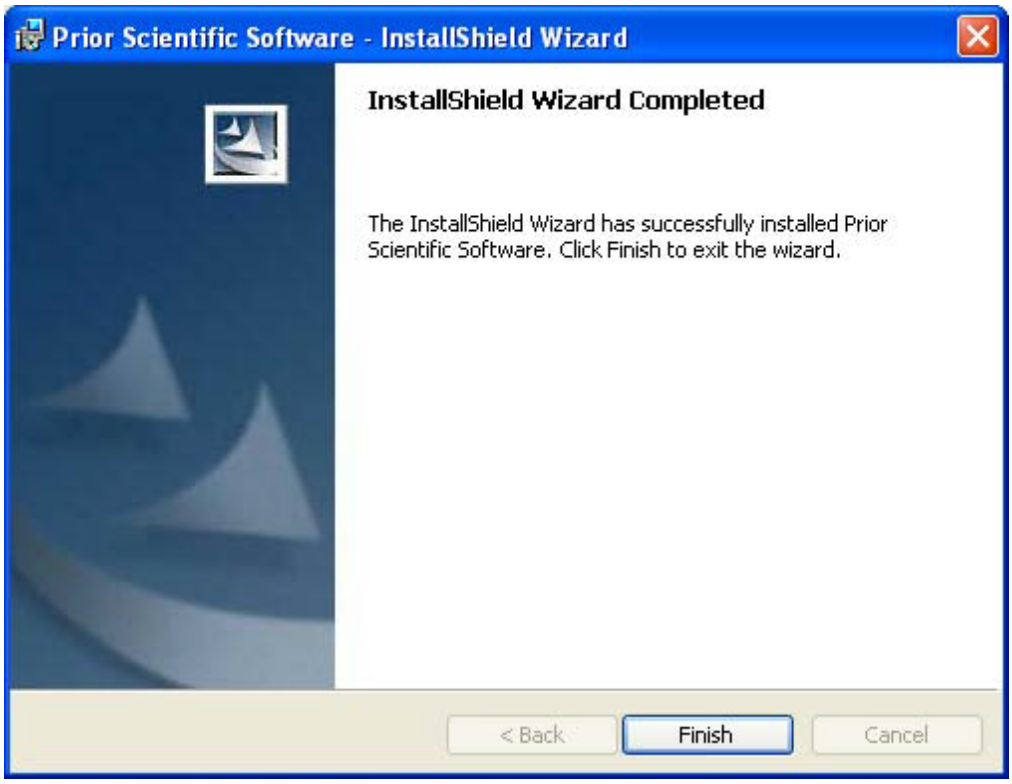
Run Setup, if you are asked by windows to allow the program to run click yes, allow or run.


Prior Scientific Software - InstallShield Wizard
Welcome to the InstallShield Wizard for Prior Scientific Software
The InstallShield(R) Wizard will allow you to modify, repair, or remove Prior Scientific Software. To continue, click Next.
< Back
Next >
Cancel

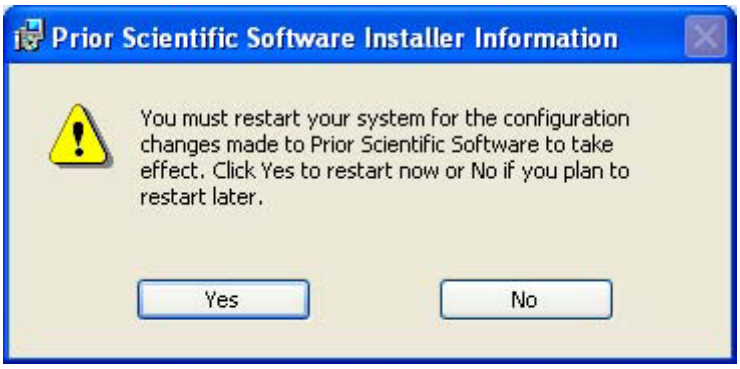
Click Next



Click install


Prior Scientific Software - InstallShield Wizard
InstallShield Wizard Completed
The InstallShield Wizard has successfully installed Prior Scientific Software. Click Finish to exit the wizard.
< Back
Finish
Cancel

Click Finish


Prior Scientific Software Installer Information
You must restart your system for the configuration changes made to Prior Scientific Software to take effect. Click Yes to restart now or No if you plan to restart later.
Yes
No

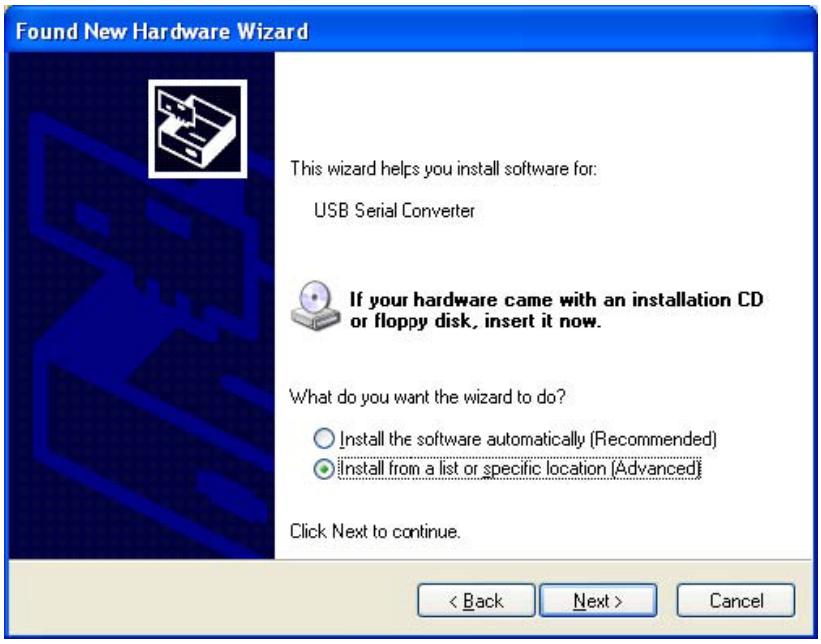
Click Yes to restart your computer immediately Click No and restart you computer before using the program.

4.1.2 Installing the Prior Communications Port for USB operation – Windows XP.

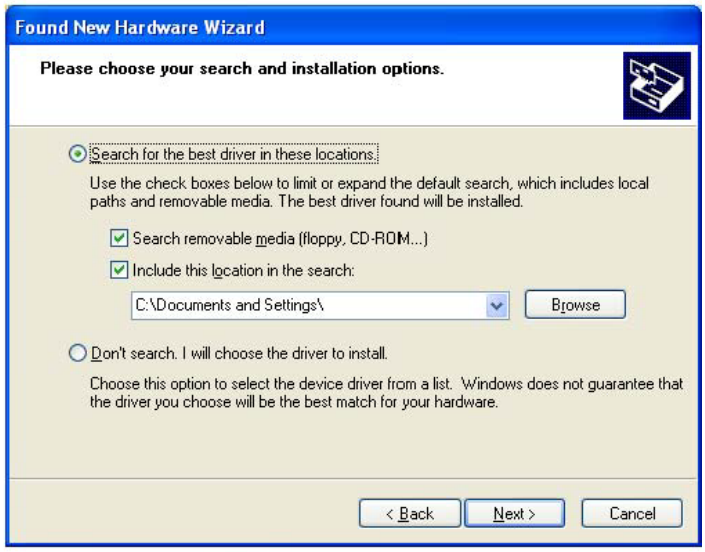
Copy the folder Prior PS3 USB Driver to your computer. Plug in the USB cable to the PS3 and computer. Switch the PS3 on. The computer will detect the new USB connection and the following popup window will appear.

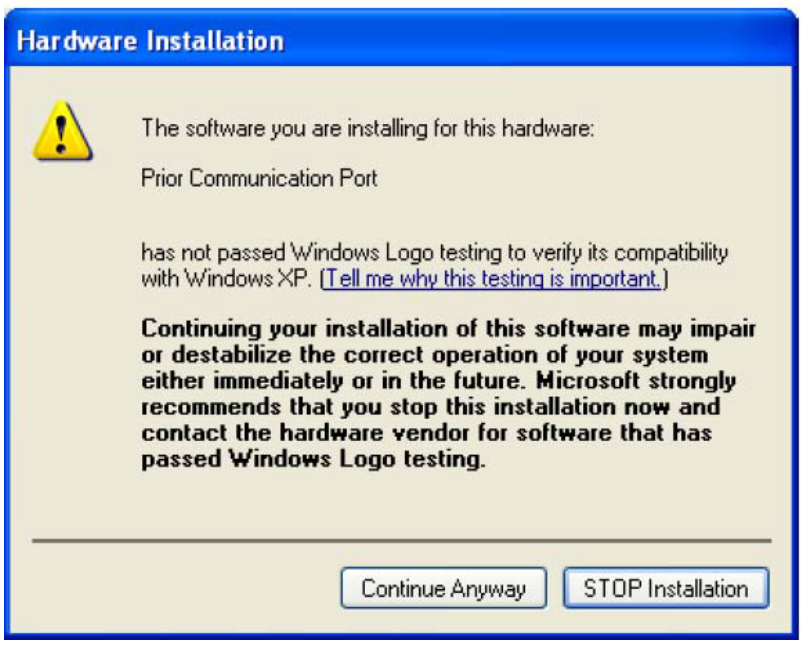
Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

When prompted select No, not at this time, then click NEXT.


Found New Hardware Wizard
This wizard helps you install software for:
USB Serial Converter
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

The following screen will be displayed.
Select "Install from a list or specific location (advanced)"
Browse to the location of Prior PS3 USB Driver folder on your desktop, click NEXT.


Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\Documents and Settings\
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel


Hardware Installation
The software you are installing for this hardware:
Prior Communication Port
has not passed Windows Logo testing to verify its compatibility with Windows XP. (Tell me why this testing is important.)
Continuing your installation of this software may impair or destabilize the correct operation of your system either immediately or in the future. Microsoft strongly recommends that you stop this installation now and contact the hardware vendor for software that has passed Windows Logo testing.
Continue Anyway
STOP Installation

Click Continue Anyway.
The Prior Communications Port will now installed.

Click Finish.
Your computer may ask you to repeat this process.

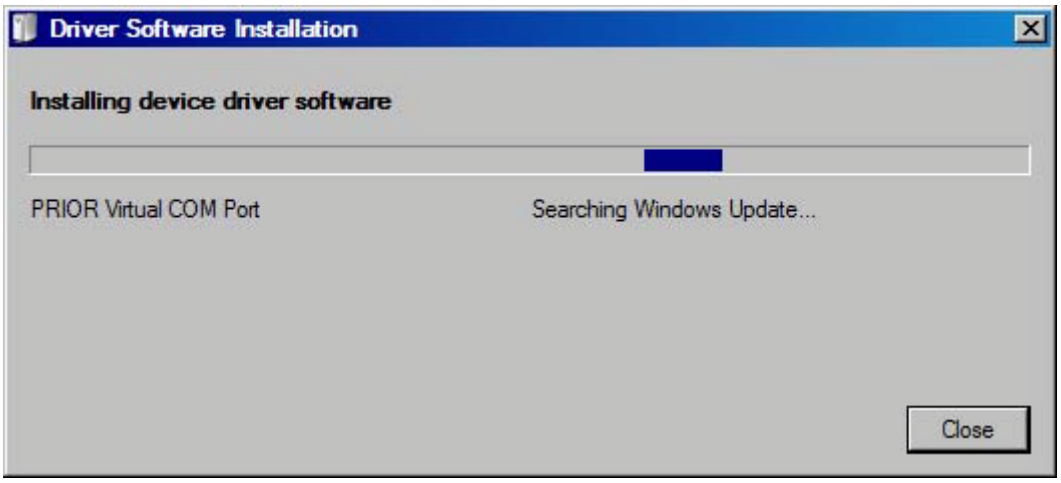
To confirm your Port Number:
Go to Start>control panel
Select System from your control panel
Select the hardware tab and then Select device manager
In device manager expand the PORTS option
The connection label "Prior Communications port" is the PS3 connection
Note the COM port associated with it.

4.1.3 Installing the Prior Communications Port for USB operation – Windows Vista.

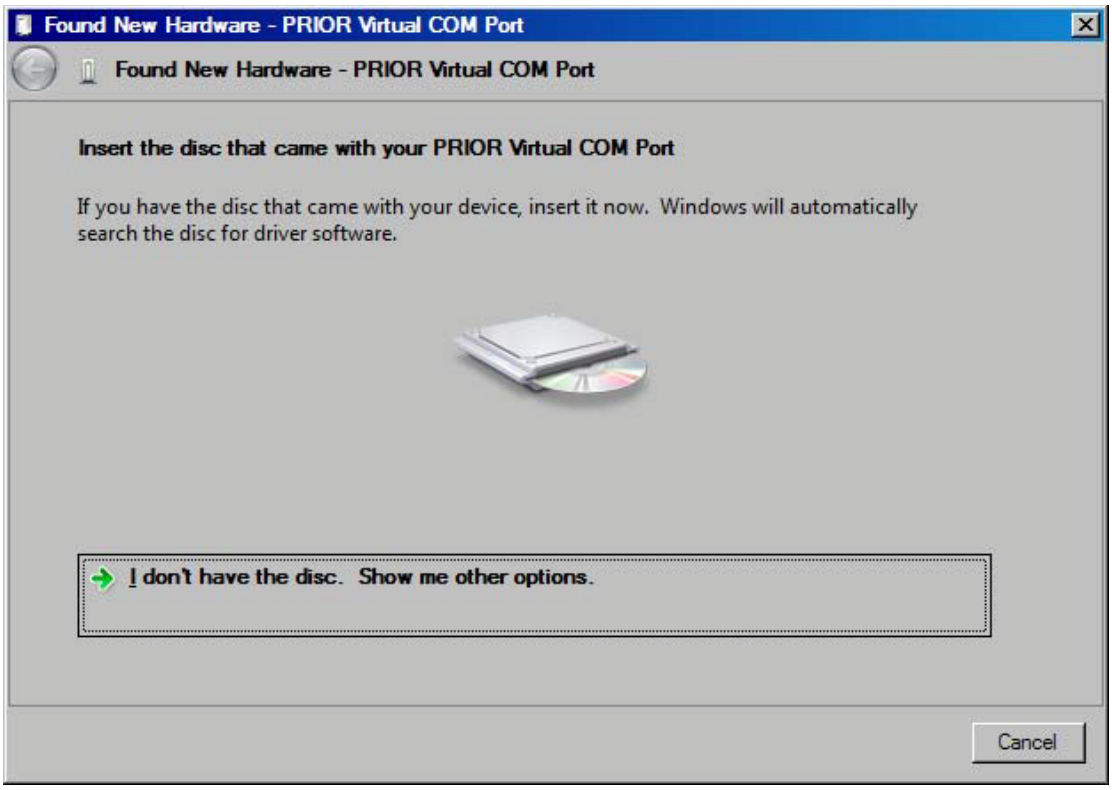
Copy the folder Prior PS3 USB Driver to your computer.
Plug in the USB cable to the PS3 and computer.
Switch the PS3 on.
The computer will detect the new USB connection and the following popup window will appear.

Found New Hardware
Windows needs to install driver software for your PRIOR Virtual COM Port
Locate and install driver software (recommended)
Windows will guide you through the process of installing driver software for your device.
Ask me again later
Windows will ask again the next time you plug in your device or log on.
Don't show this message again for this device
Your device will not function until you install driver software.
Cancel

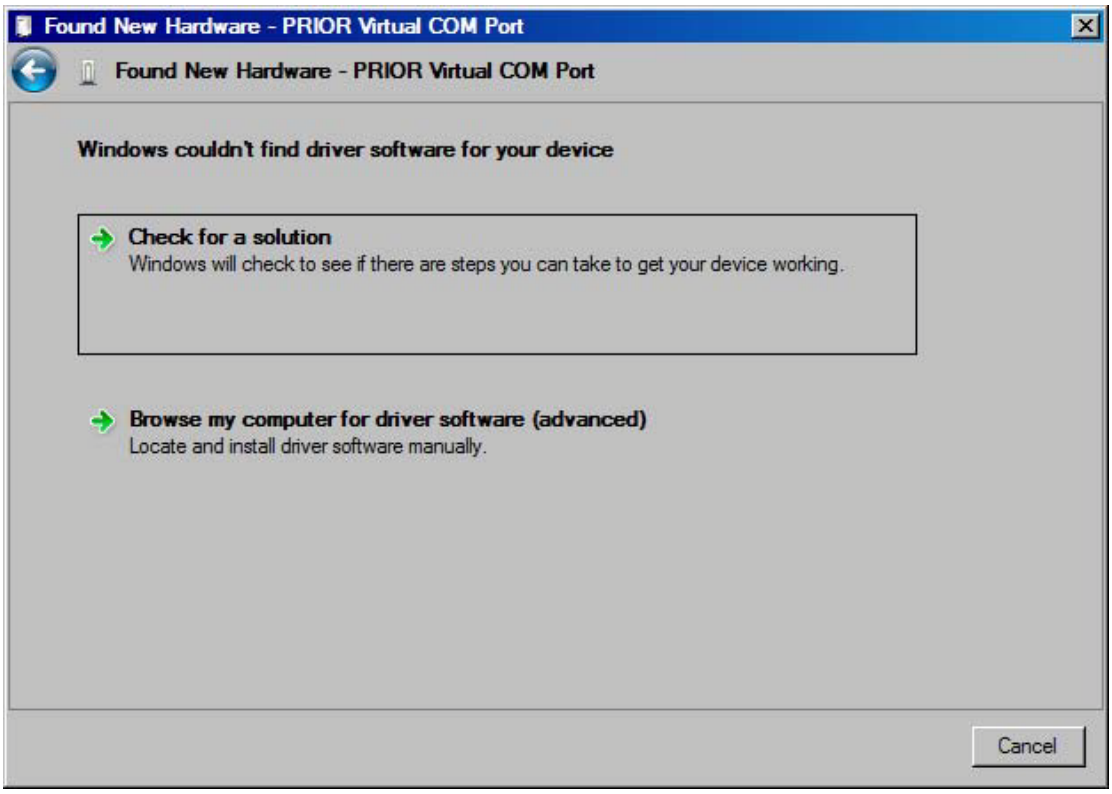
Click Locate and install driver software.



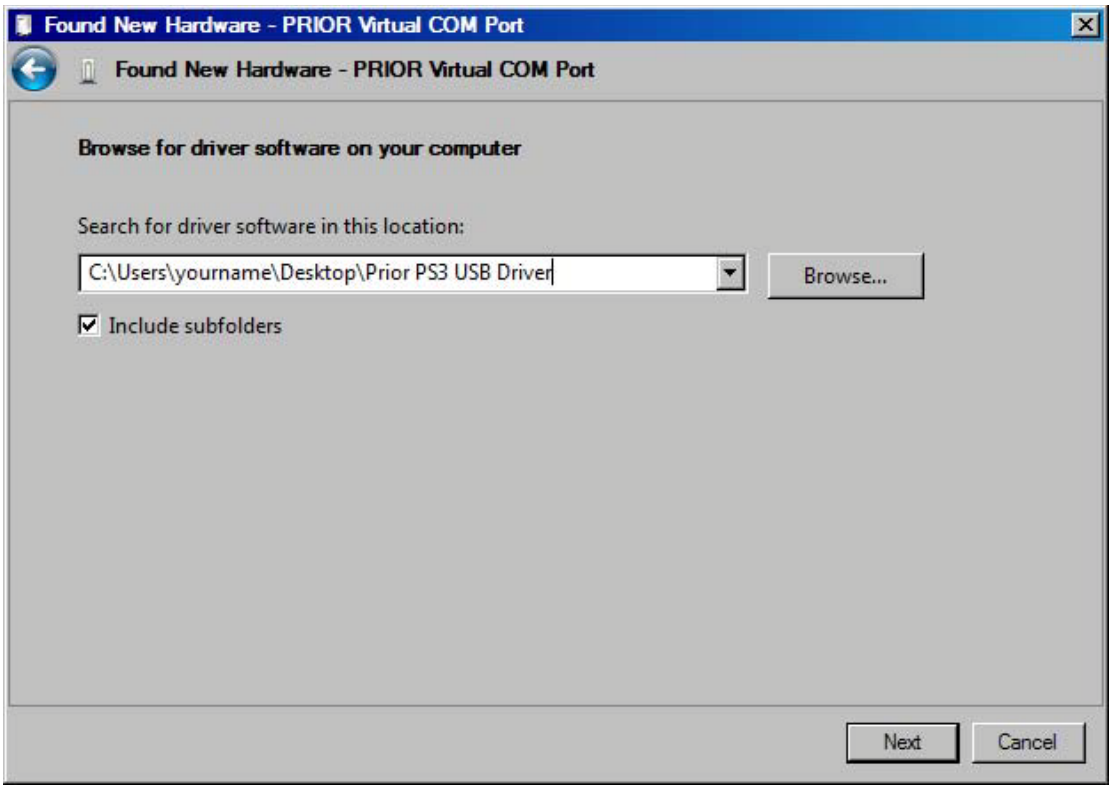
This window may appear at the bottom of your screen, wait. The following window will appear.


Found New Hardware - PRIOR Virtual COM Port
Found New Hardware - PRIOR Virtual COM Port
Insert the disc that came with your PRIOR Virtual COM Port
If you have the disc that came with your device, insert it now. Windows will automatically search the disc for driver software.
I don't have the disc. Show me other options.
Cancel

Click I don't have the disc. Show me other options.
The following window will appear.


Found New Hardware - PRIOR Virtual COM Port
Found New Hardware - PRIOR Virtual COM Port
Windows couldn't find driver software for your device
Check for a solution
Windows will check to see if there are steps you can take to get your device working.
Browse my computer for driver software (advanced)
Locate and install driver software manually.
Cancel

Click Browse my computer for driver software (Advanced).


Found New Hardware - PRIOR Virtual COM Port
Found New Hardware - PRIOR Virtual COM Port
Browse for driver software on your computer
Search for driver software in this location:
C:\Users\yourname\Desktop\Prior PS3 USB Driver
Browse...
Include subfolders
Next
Cancel

Click Browse and browse to the location of Prior PS3 USB Driver folder, click NEXT.

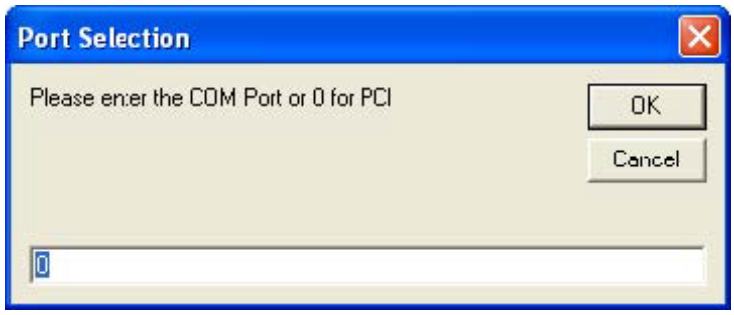
Windows Security
Windows can't verify the publisher of this driver software
Don't install this driver software
You should check your manufacturer's website for updated driver software for your device.
Install this driver software anyway
Only install driver software obtained from your manufacturer's website or disc. Unsigned software from other sources may harm your computer or steal information.
See details

Click Install this driver anyway.

Click Finish.

4.2 Using the Freeware.

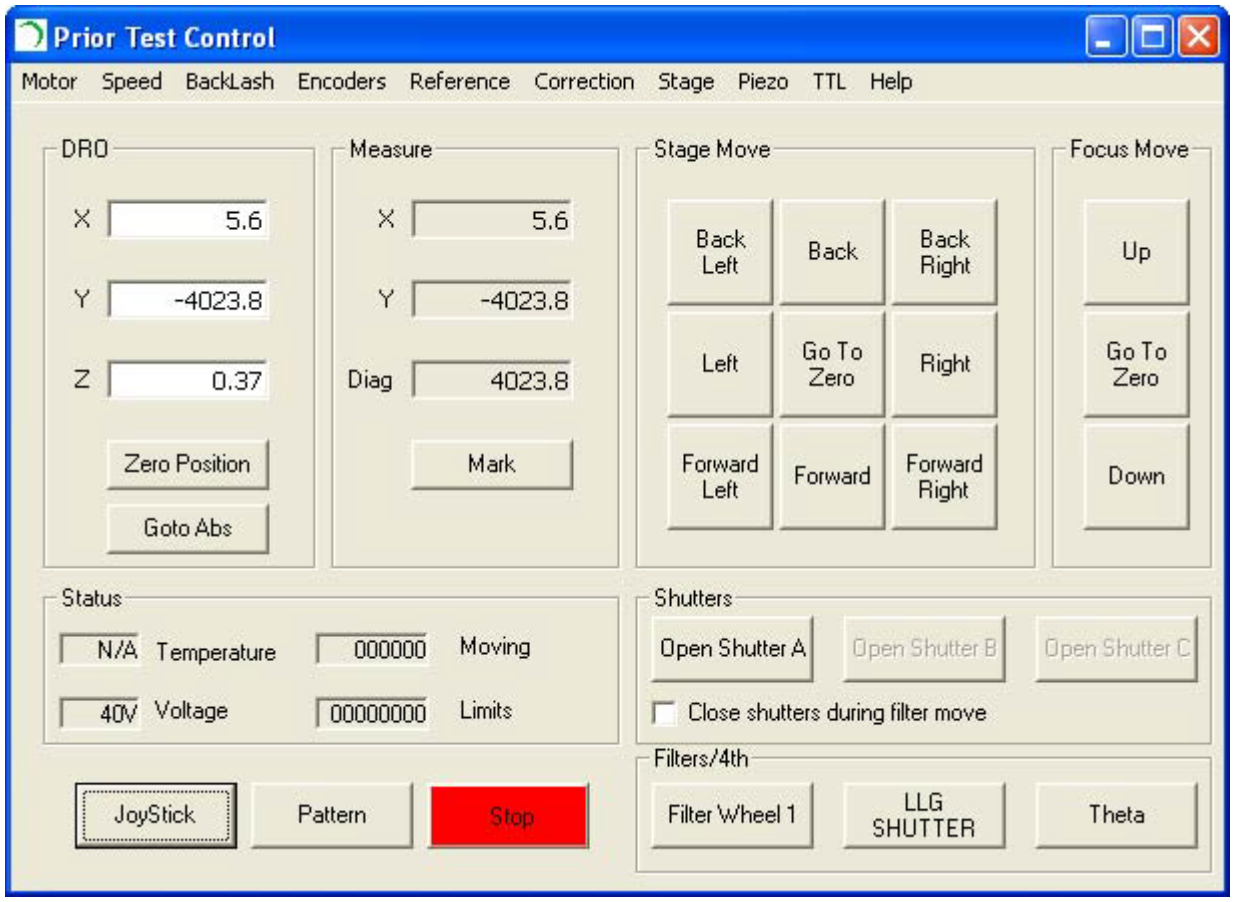
Run the Prior Software from Start menu>Program> Prior Scientific>Visual Basic>Controller Demo



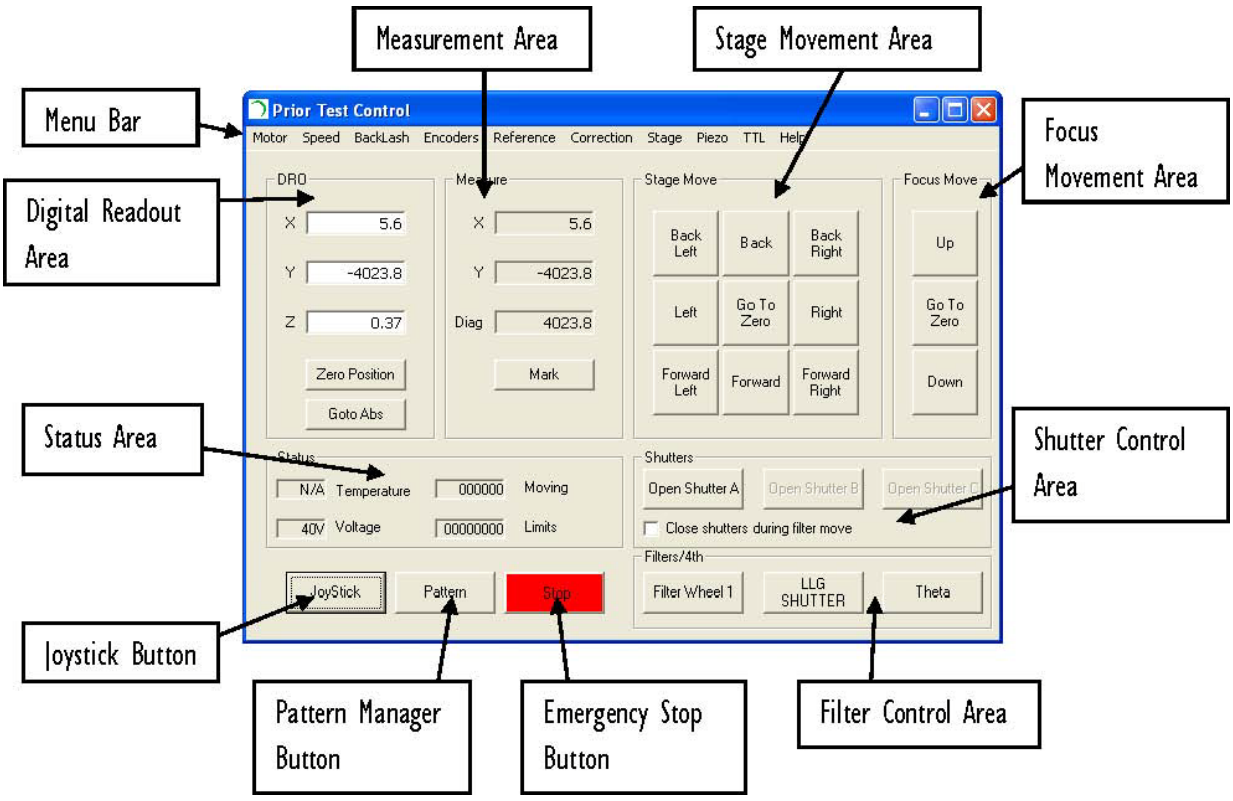
Enter the number of the COM port the ProScan controller is attached on.

Tip: To find the virtual COM port use Start menu>Control panel>system the click the Hardware tab then the Device manager button, expand the ports section to identify and virtual COM ports.

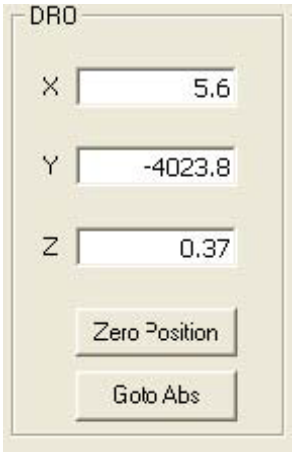
The Following screen will be displayed.



Only attached accessory sections will be active, e.g., if there are no shutters all of the Shutter buttons in the Shutter area will be light grey and inactive.



Identification of Program areas.
The Digital Readout Area:



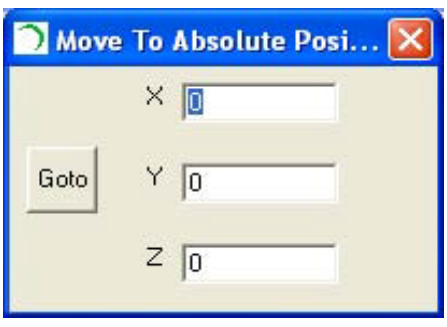
X is the X position (in microns)

Y is the Y position (in microns)

Z is the Z position (in microns, if the UPR is set correctly for the microscope)

Zero Position Button: Zero's all three positions, all previous positional information is lost.

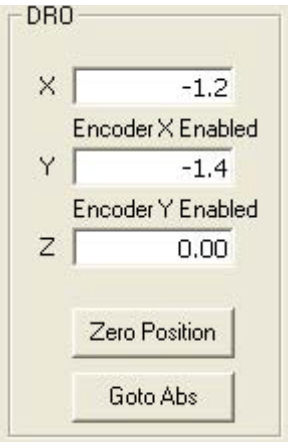
Goto Abs Button:



Type the X Y and Z position you require and Press Goto.

Moves the X Y and Z to the absolute X Y and Z position.

Digital Readout with Encoders

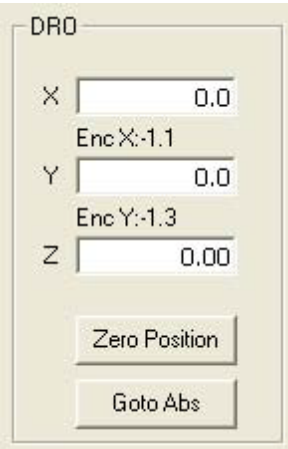


X value using encoder (Based on the encoder settings)

Y value using encoder (Based on the encoder settings)

No z encoder fitted, Z position (in microns, if the UPR is set correctly for the microscope)

Digital Readout with encoder fitted but disabled.



X is the X position (in microns)
EncX: X encoder position
Y is the Y position (in microns) Enc Y: Y encoder position
Z is the Z position (in microns, if the UPR is set correctly for the microscope)

Measurement Area:

X distance from marked position to current position.

Y distance from marked position to current position.

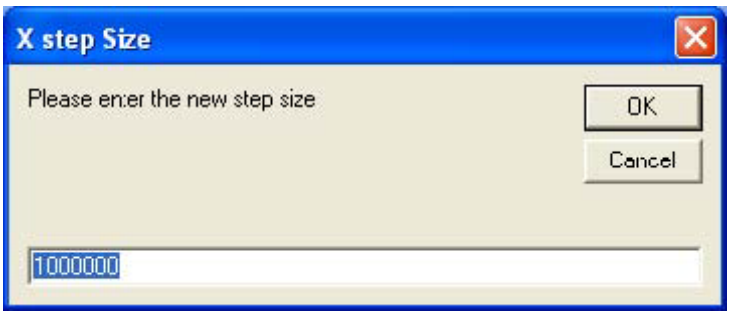
Diagonal distance from marked position to current position.

Click Button to make current position marked position.

Stage Move Area:

Click buttons to move stage set distances (default 1000um).
Back, Forward (Y)
Left, right (X)

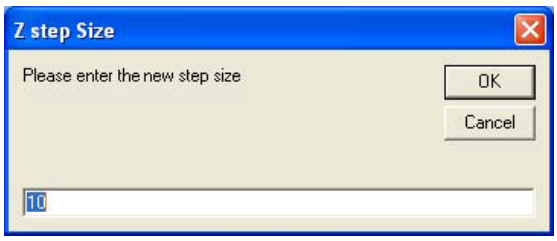
Right click with mouse to set the distance travelled.



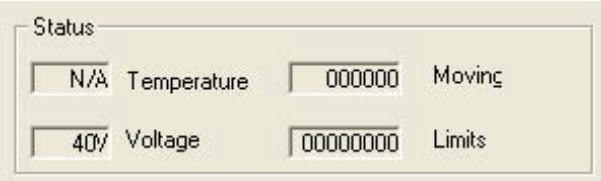
Type in the step size (distance travelled) in microns and click ok.

Focus Move Area:

Click buttons to move focus set distances (default 10um).
Go To Zero: move the focus to absolute zero.
Right click with mouse to set the distance travelled.
Type in the step size (distance travelled) in microns and click ok.

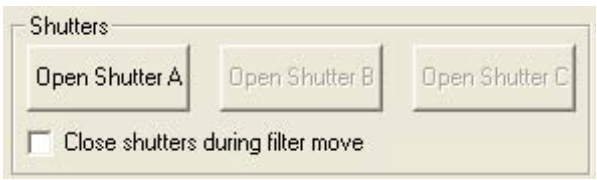


Status Area:



Temperature: Chip temperature is displayed if available.
Voltage: Supply voltage is displayed.
Moving: Displays six digits, one for each axis, 0 if the axis is stationary and 1 if it is moving. All digits are always displayed in the following order: F3,F2,F1,Z,Y,X e.g., 0010011 indicates the Filter 1, X and Y are moving.
Limits: Displays eight digits, one for each end of each axis, 0 is not active 1 is limit active. All digits are always displayed in the following order: F3-, F3+, Z-,Z+,Y-,Y+, X-,X+.

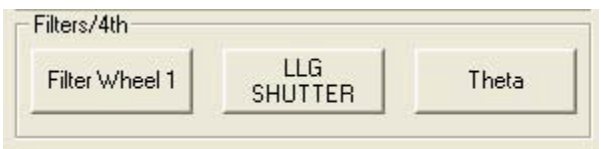
Shutters Area:



Click the appropriate button to Open or Close an attached shutter. If the button is greyed out the shutter is not detected.

Check the Close shutter during filter move to close all shutter when any attached filter wheel is moved.

Filters/4th Area:

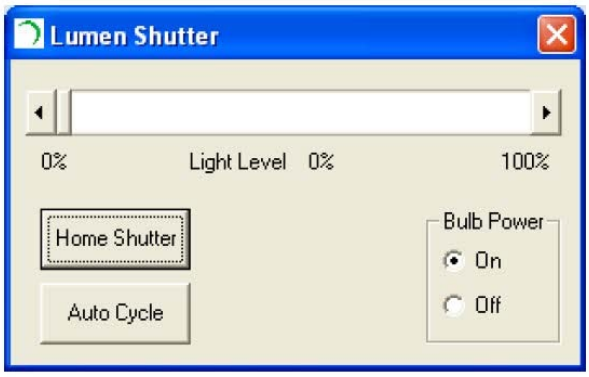


Click the appropriate button to open another window to access the Filter Wheel, Lumen Attenuator, or 4th Axis Accessory. Greyed out buttons show when no accessory is detected.

Filter Wheels:

Current position is displayed in the top left area. Click Next to move the next filter wheel position Click previous to move the previous filter wheel position. Click Home to Home the Filter wheel. Check the home on start, to activate the home on startup feature which will automatically home the filter wheel when the ProScan unit is power cycled.

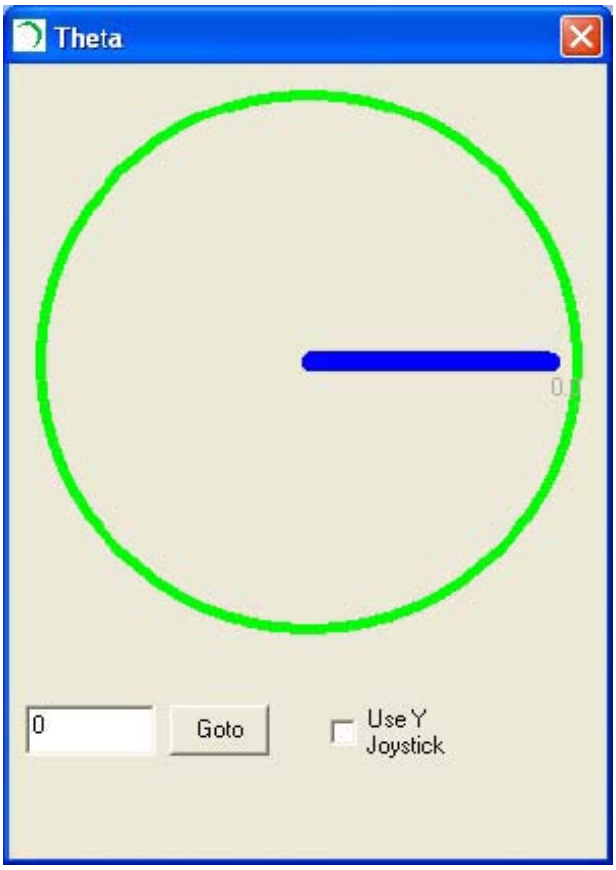
Lumen Attenuator:



Use the scroll bar to set the light output level from 0 to 100%.
Click the Home Shutter to home the shutter, this should be done on start-up.
Auto Cycle, click to automatically cycle the unit through 0-100% light output, Click cancel to stop.

Bulb Power: Switches entire Lumen On/Off
On Lumen ON
Off, Lumen Off

4th Axis – Theta:



Displays the position of the theta insert or stage axis.
Type a angle position 0-360 degrees into the Goto box and click Goto to move the axis to that angle.

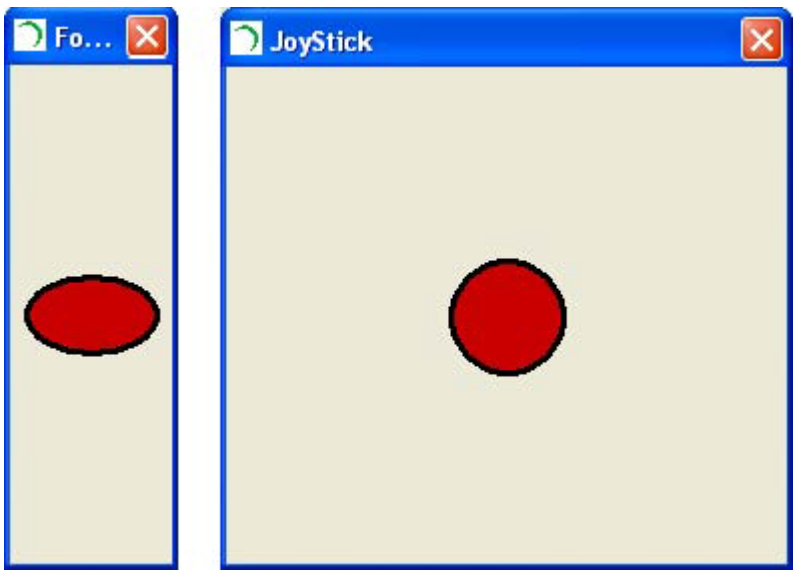
* Check the Use Y Joystick box to enable the Y axis of the Joystick to be used as the Theta controller.

* Only available on CS Joysticks.

Buttons:

Stop: Press this button to stop all axis immediately. Pattern: Click the Pattern button the launch Pattern Manager, discussed later in this manual.

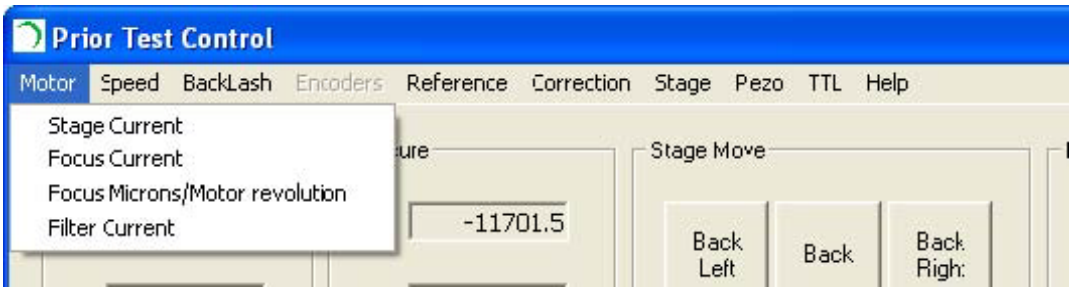
Joystick: Click Joystick to launch the Joystick windows.



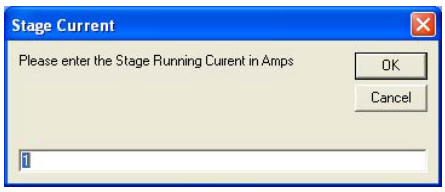
The Focus Joystick control Focus.
The Joystick controls X and Y axis.
Drag the Red ball to make the axis move.

Menu Functions:

Motor

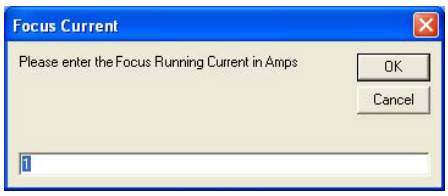


Stage Current



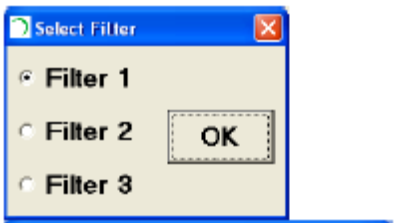
Sets the running current for the Motors on the stage between 0 and 1.5Amps.
WARNING: Changing this value may damage your motors.

Focus Current

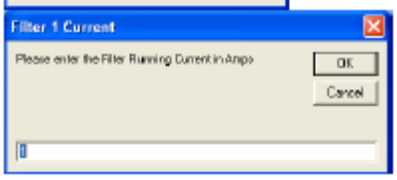


Sets the running current for the Motors on the focus between 0 and 1.5Amps.
WARNING: Changing this value may damage your motors.

Filter Current

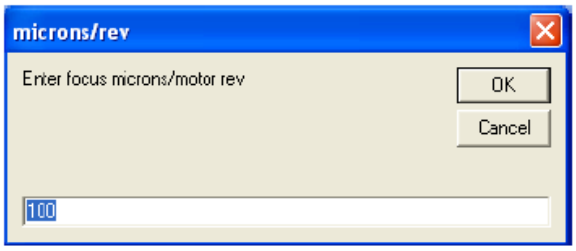


Select the filter wheel axis you would like to change the drive current for and click OK.



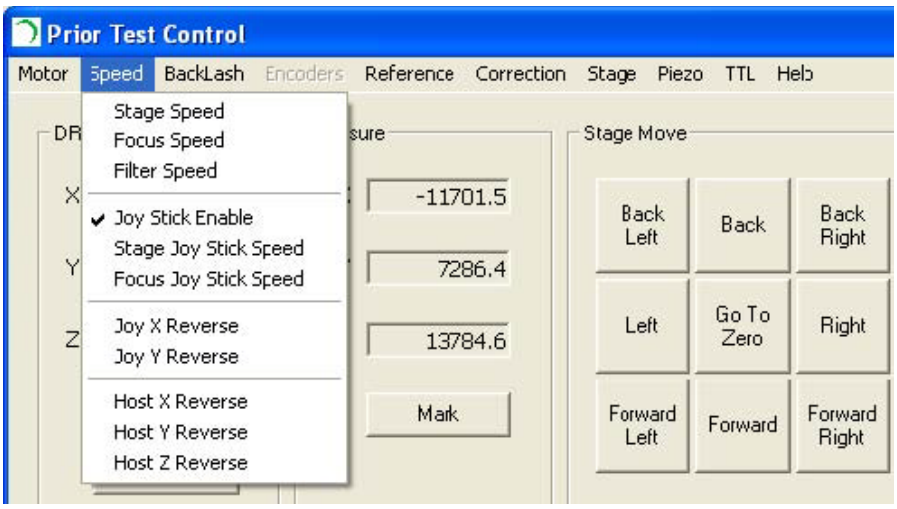
Sets the running current for the Motors on the filter wheel axis between 0 and 1.5Amps
WARNING: Changing this value may damage your motors.

Focus microns/motor revolution:

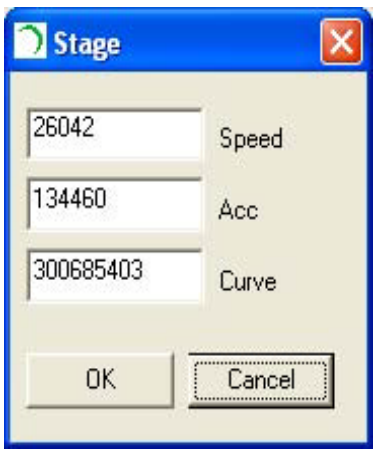


Enter here the number of microns the microscope focus moves when the fine focus knob is rotated 1 resolution.
This enables the micron value in the display to be related correctly to the attached microscope

Speed Menu:



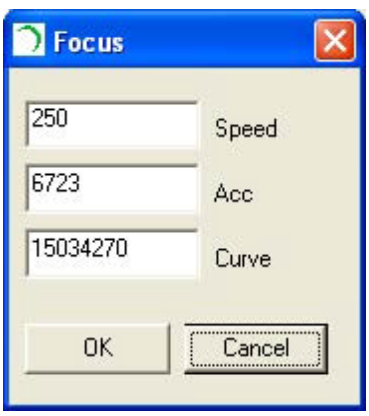
Stage Speed



Changes the intrinsic characteristics of the stage. Speed in micro steps per second Acceleration in micro steps per second per second

WARNING: Stage may stall under certain settings.

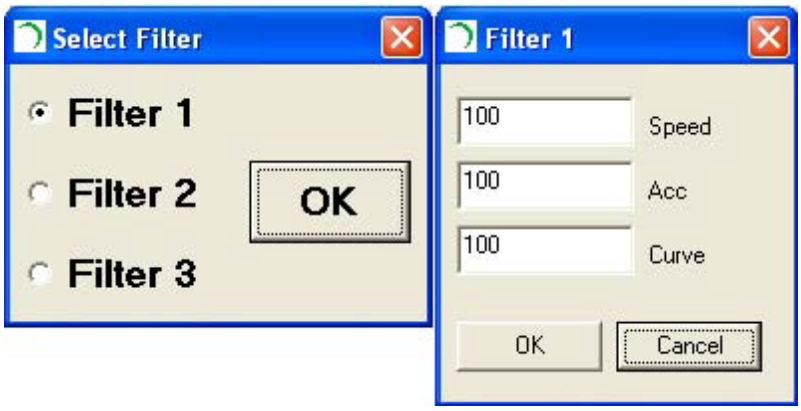
Focus Speed



Changes the intrinsic characteristics of the focus. Speed in micro steps per second Acceleration in micro steps per second per second

WARNING: Focus may stall under certain settings.

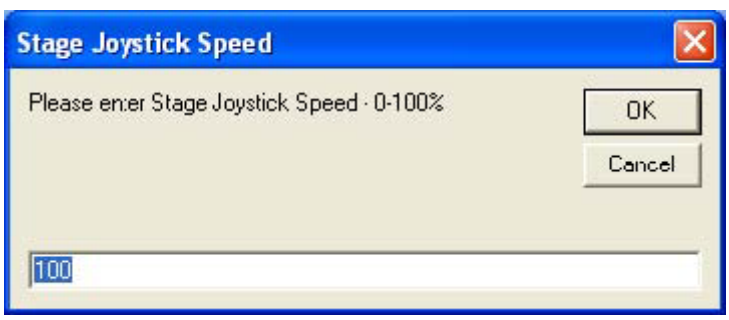
Filter Speed:



Select the filter axis you wish to change.
Changes the characteristics of the selected filter axis. Speed, 1-100%
Acceleration 4-100%
Curve (See S-Curve) 1-100%
WARNING: Filter axis may stall under certain settings.

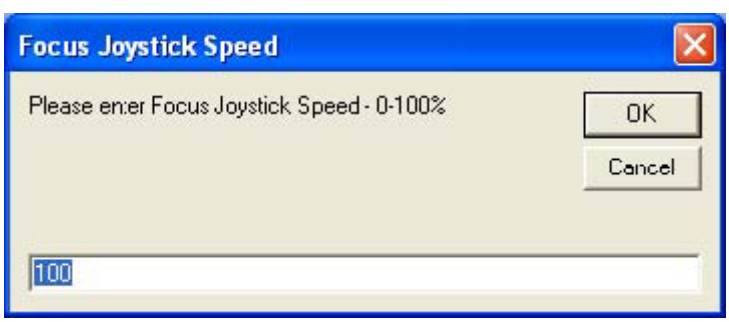
Joystick Enable: Enables or Disables Joystick, check to enable.

Stage Joystick Speed:



Enter the % speed from 0-100% for the Joystick to move the stage.

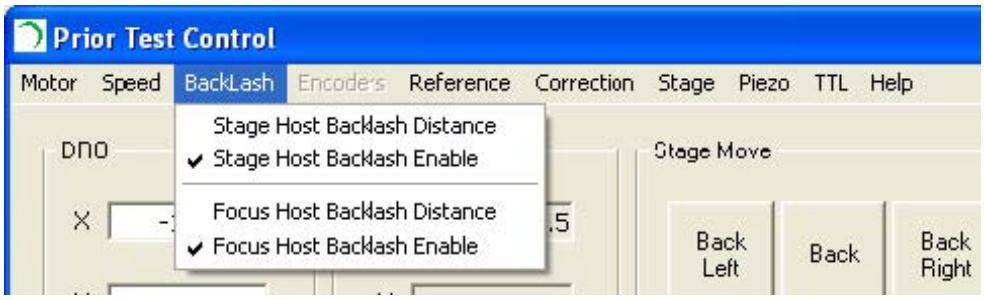
Focus Joystick Speed:



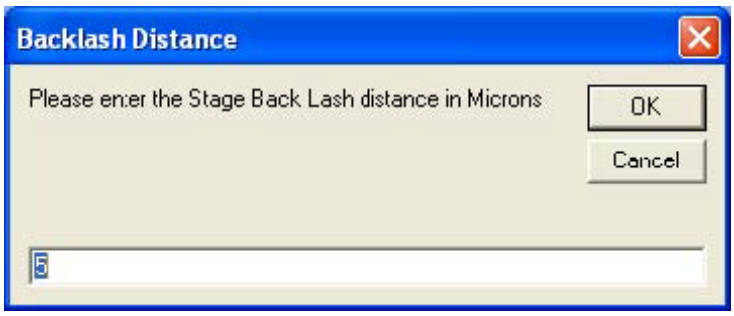
Enter the % speed from 0-100% for the Joystick to move the focus.

Joy X reverse: Check to reverse the direction of the X axis under Joystick control. Joy Y reverse: Check to reverse the direction of the Y axis under Joystick control. Host X reverse: Check to reverse the direction of the X axis under computer control. Host Y reverse: Check to reverse the direction of the Y axis under computer control. Host Z reverse (Focus): Check to reverse the direction of the Z (Focus) axis under computer control.

Backlash Menu:



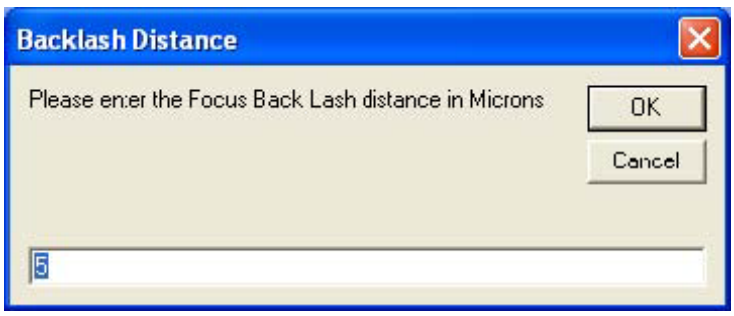
Stage Host Backlash Distance:



Sets the distance the stage will move when under computer control and performing the backlash correction. Input the number of microns required.

Stage Host Backlash Enable: Check this to enable the backlash feature for computer control on the stage.

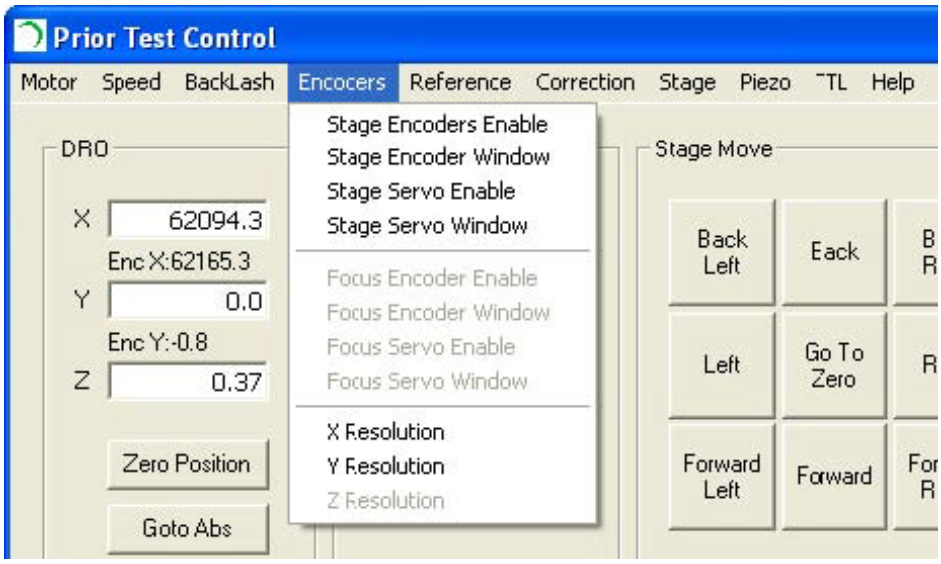
Focus Host Backlash Distance:



Sets the distance the focus will move when under computer control and performing the backlash correction. Input the number of microns required.

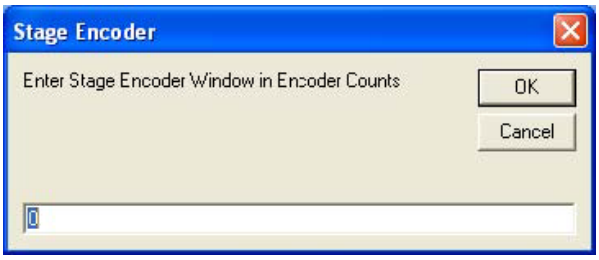
Focus Host Backlash Enable: Check this to enable the backlash feature for computer control on the focus axis.

Encoder Menu:



Stage Encoders Enable: Check this to enable the encoders to function with the stage.

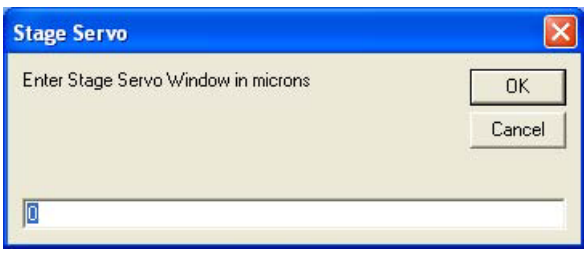
Stage Encoder Window:



Encoder window. The controller will move the stage to an encoder position, the encoder window is the number of encoder counts away from this position the system can be. If the encoder window is set too small the system may move continually as it is unable to reach the exact position requested.

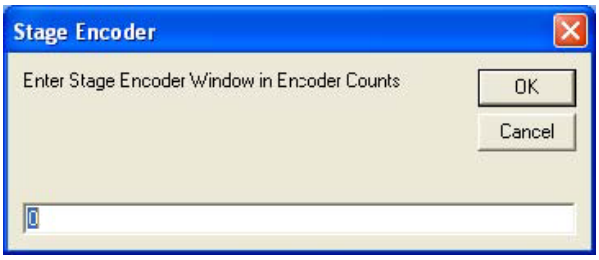
Stage Servo Enable: Check this to enable stage servo. This is make the stage attempt to stay at the programmed position. Use this function to overcome drift in time-lapse experiments.

Stage Servo Window:



Servo Window. When in servo mode the controller will attempt to keep the stage at a particular position. The servo window is the number of encoder counts the stage can move before the controller will respond and correct the position.

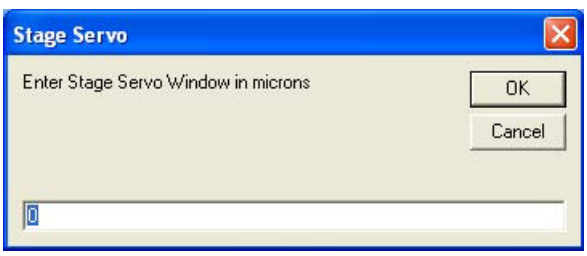
Focus Encoders Enable: Check this to enable the encoders to function with the focus.
Focus Encoder Window:



Encoder window. The controller will move the focus to an encoder position, the encoder window is the number of encoder counts away from this position the system can be. If the encoder window is set too small the system may move continually as it is unable to reach the exact position requested.

Focus Servo Enable: Check this to enable focus servo. This is make the focus attempt to stay at the programmed position. Use this function to overcome drift in time-lapse experiments.

Focus Servo Window:



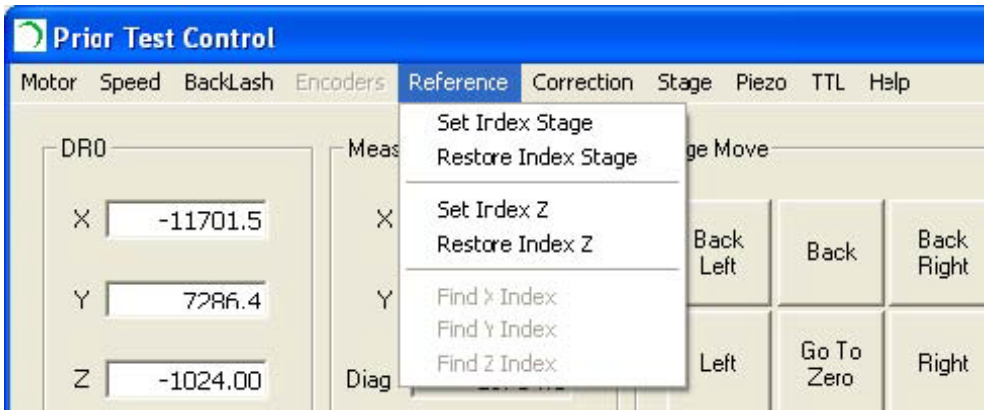
Servo Window. When in servo mode the controller will attempt to keep the focus at a particular position. The servo window is the number of encoder counts the focus can move before the controller will respond and correct the position.

X Resolution: Sets the encoder resolution for the X axis, this determines the micron number displayed in the DRO. Use negative number to reverse the direction if encoder reversed.

Y Resolution: Sets the encoder resolution for the Y axis, this determines the micron number displayed in the DRO. Use negative number to reverse the direction if encoder reversed.

Z Resolution: Sets the encoder resolution for the Z axis, this determines the micron number displayed in the DRO. Use negative number to reverse the direction if encoder reversed.

Reference Menu:



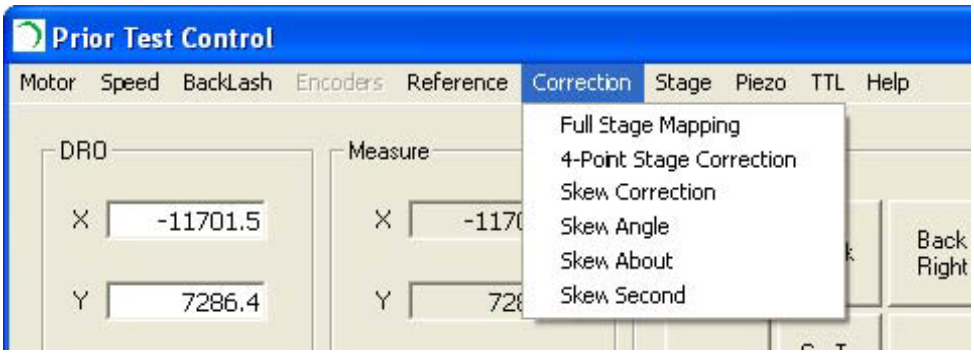
Set Index of Stage: Unencoded: Moves stage to X+ and Y+ limits (Forward and left) and sets 0. Encoded: Moves stage to X+ and Y+ limits, (Forward and left) and sets motor count to 0, then returns the stage to reference points on encoders and set position 0.

Restore Index of stage: Completes a Set Index of Stage move then returns the stage to the position it was originally at.

Set Index Z (Requires Z limits): Moves the focus to Z+ limit and sets motor count to 0.

Restore Index of Z: Completes a Set Index of Z then moves the focus to the position it was originally at.

Correction Menu:



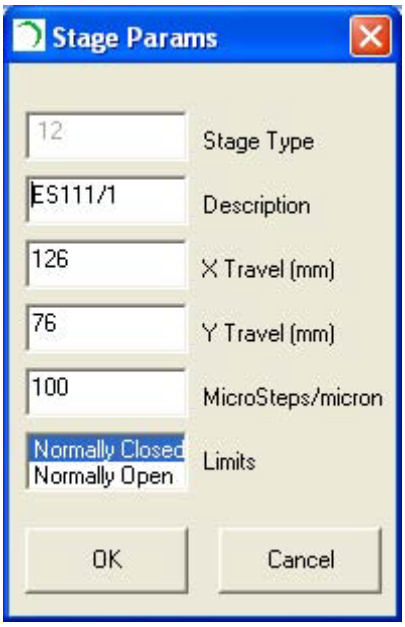
Full Stage Mapping: Check to enable Full stage mapping. (Set Stage Index must be complete on startup and stage must be enabled with All point mapping).

4-point Stage Correction: Check to enable IST stage correction.

Skew Correction: Enables Basic Skew correction using the parameters from Skew Angle, Skew About and Skew Second.

Skew Angle: Skew the stage by the angle inputted.
Skew About: Skews the stage between about this point with the above angle.
Skew Second:

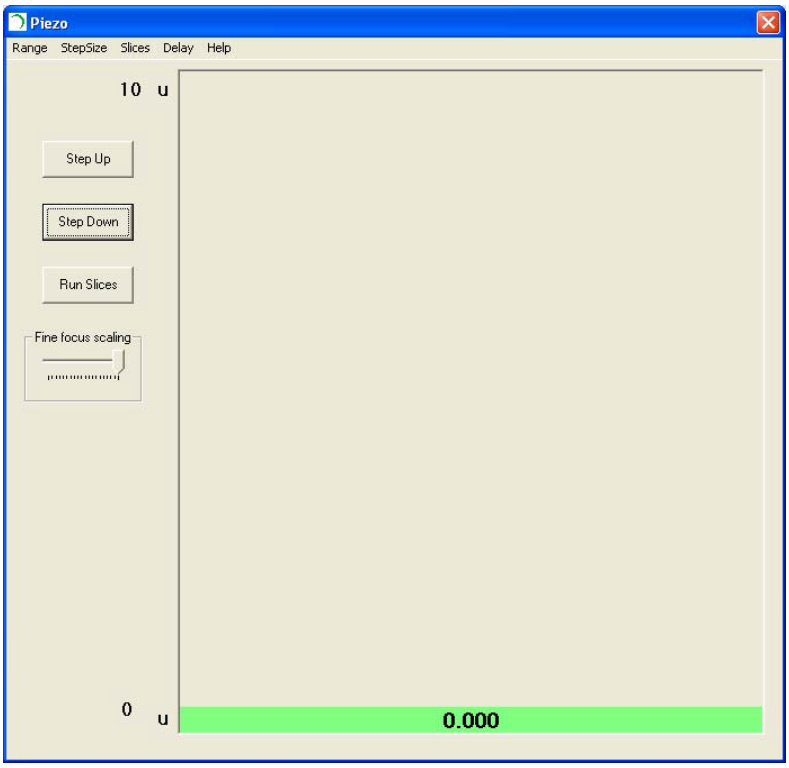
Stage menu:



Displays information about the stage attached.

Piezo Menu:

Launches Piezo window if Piezo attached either directly via Com or via the RS232-2 port on ProScan. If connected on separate COM port Click Yes, if No check connections.



Range: Reports the Range of the Piezo.
Step Size: Sets the step size for the Step up and Step down buttons.
Slices: Set the number of slices for the run slices button.
Delays: sets the delay between the slices for the run slices button.
Run Slices: Runs a program stepping though a number of equal slices between the position the stage is at to zero.
Click into the area above the green banner and drag to mouse to make the piezo stage move. Use the Fine Focus scaling to increase and decrease the speed of movement.

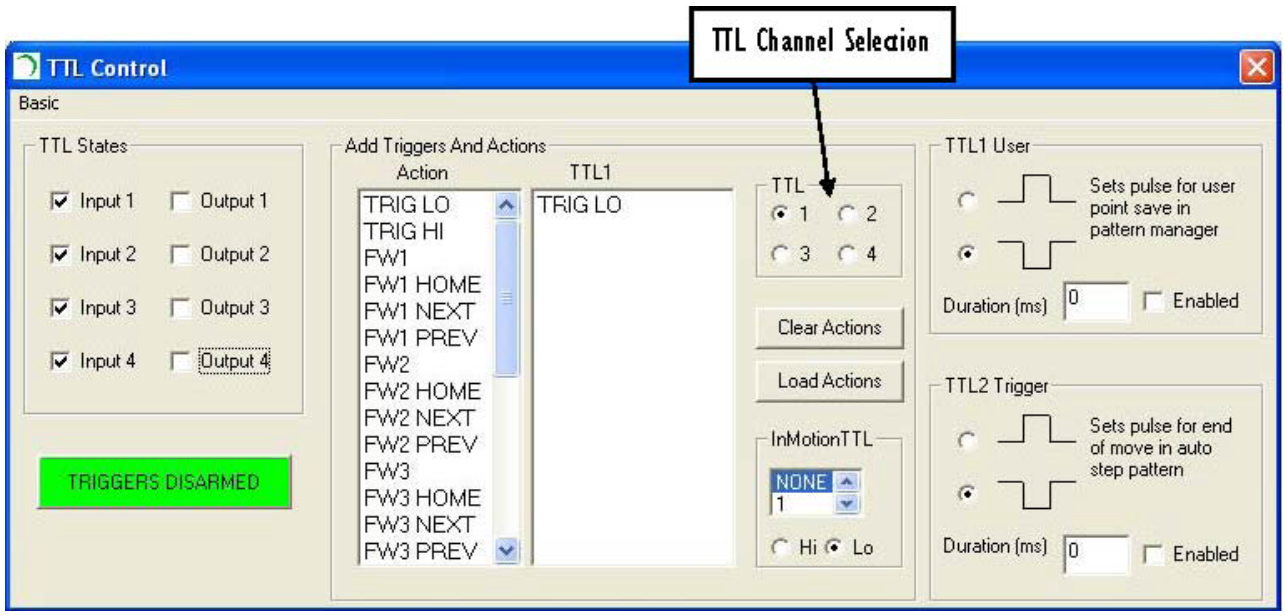
TTL Control Menu:

For basic TTL control and indication use the basic screen, check the boxes to output high signals and uncheck them to output low signals. The inputs will indicate if the signal is high(checked) or low (unchecked).

Advanced TTL control:

This allows the programming of the auto response TTL system. Use this to trigger events in the controller via TTL. E.g., use the TTL to move a stage or open and close a shutter.

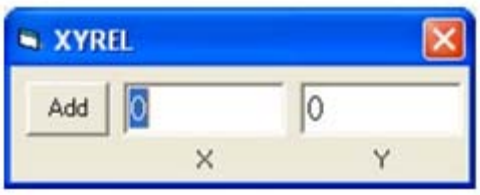
Supported Functions are:
Lumen Attenuator, move to % open.
Filter wheels: move to Next, Previous, Home and Move to position.
Shutter: Open and Close.
XYZ axis: Relative and Absolute Moves.
NanoScanZ (Piezo): Relative and Absolute Moves



Ensure triggers are disarmed. (Button should be green).
Clear actions using Clear Actions button for each individual TTL channel.

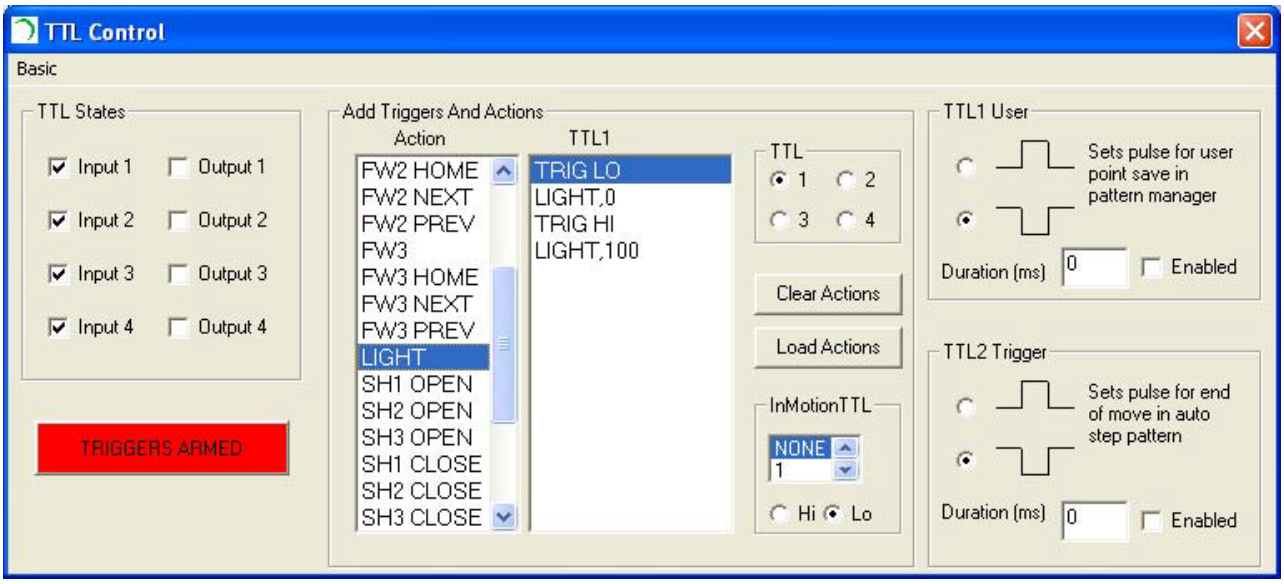
Select the TTL channel you would like to program (only program the TTL lines you require).
TRIG LO is displayed in the TTL window, select the Action to be assigned to TTL Low, if no function select TRIG HI.
For some action a window is opened, fill in the appropriate information to enable the assigned action.

e.g., Type in the % of light you would like the lumen attenuator to



e.g., Type in the relative move you would like the stage to make and then click add.

Click TRIG HI, if a action is to be assigned to TTL Hi, if not move onto the next step. Select the Action to be assigned to TTL Hi.



Click Load Actions to Load the actions to for that particular TTL to the ProScan Controller. Repeat the process for each of the TTL channels required.

If you require the InMotion TTL, i.e., if an axis is in motion this function will set a TTL output high or Low when in motion.
Select the TTL and check Hi or Low as required.
Click load Actions.

To Arm the system and make it respond to TTL inputs and outputs Click the Triggers disarmed button, this will change colour to red and display Triggers Armed as above.

You system will now respond the TTL inputs as programmed.

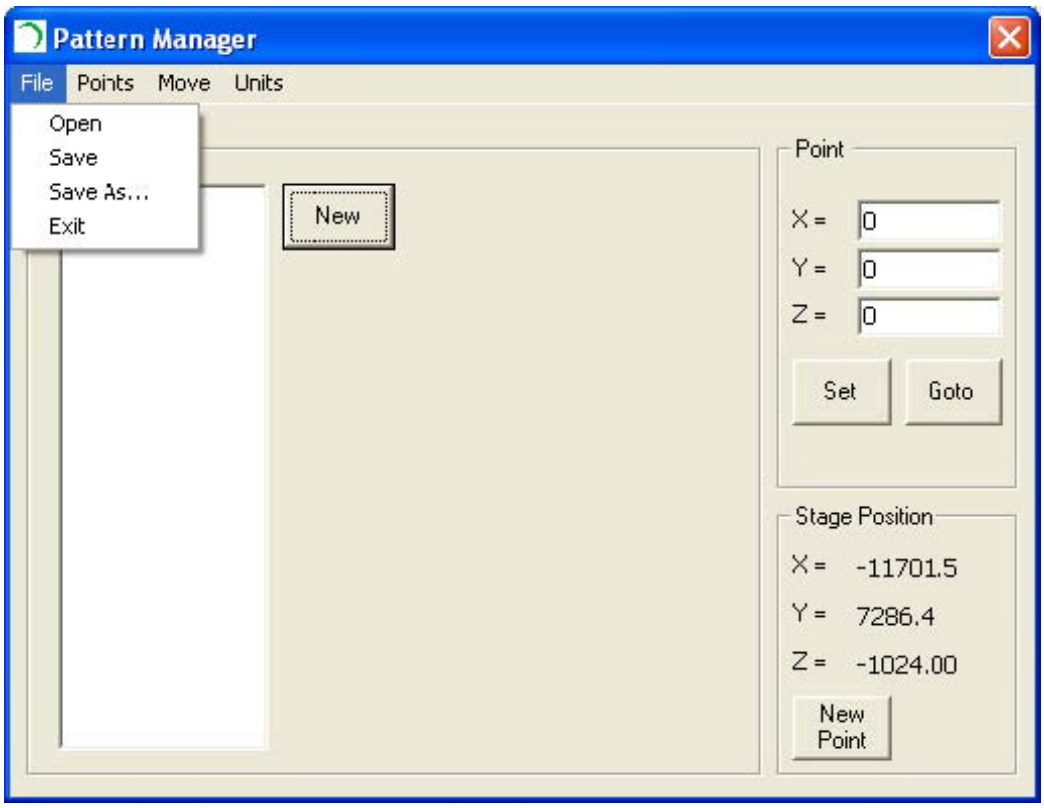
TTL1 User and TTL 2 Trigger, these functions are for use with the Pattern manager described in the next section.

TTL 1 User sets the length in ms and orientation, high-low-high or low-high-low of a TTL trigger pulse outputted on TTL 1 when a point is saved at the end of each move of a pattern in pattern manager. Enable the feature by checking the Enable box.

TTL 2 Trigger sets the length in ms and orientation, high-low-high or low-high-low of a TTL trigger pulse outputted on TTL 2 at the end of each move of a pattern in pattern manager. Enable the feature by checking the Enable box.

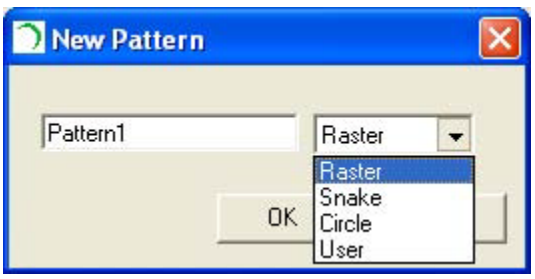
Pattern Manager:
The pattern manager is designed to drive the stage in various patterns, with the TTL trigger functions enabled this can but used to automatically gather the pictures for tilling or stitching.

Click the pattern button on the main screen of the program.



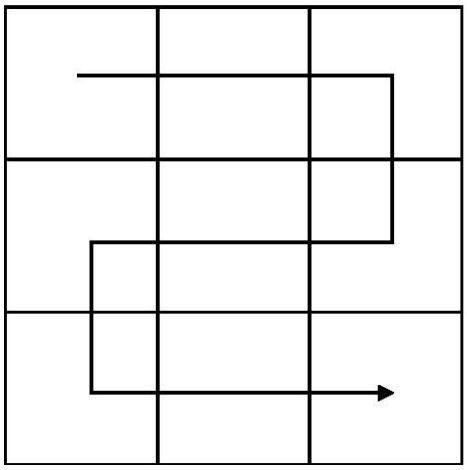
You can open a previous saved pattern or save a pattern using the File menu.

Click New to create a new pattern

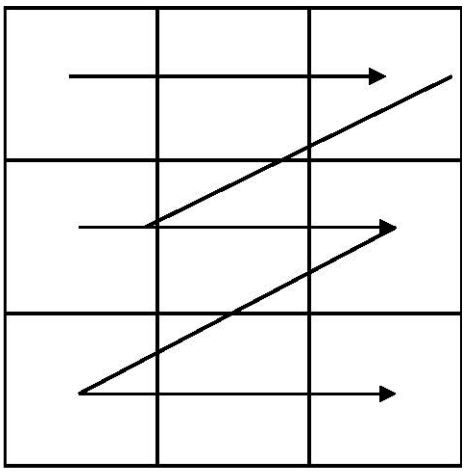


Select the type of Pattern Type in a name for the pattern, and select a type. The four choices determine how the stage moves through the pattern.

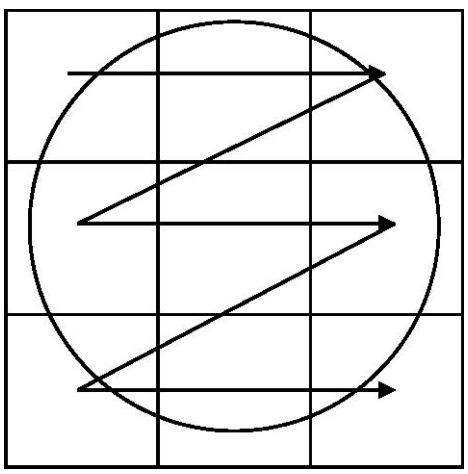
Snake



Raster:



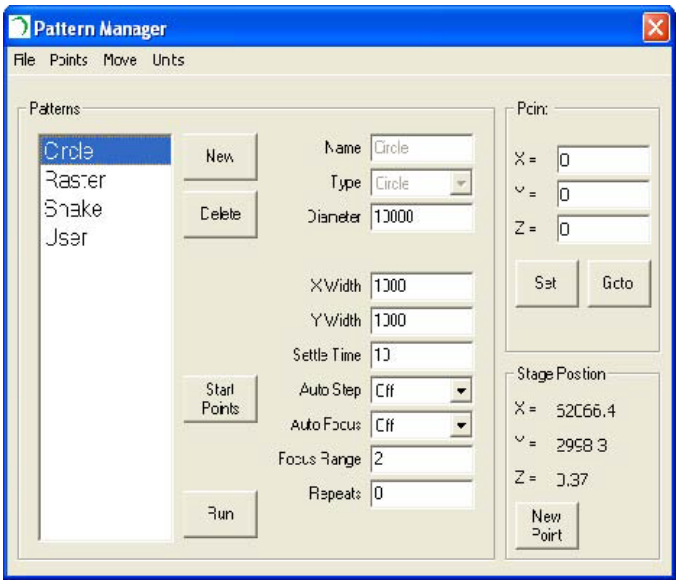
Circle:



User:
User pattern is defined as a number of User points, these points are followed in order.

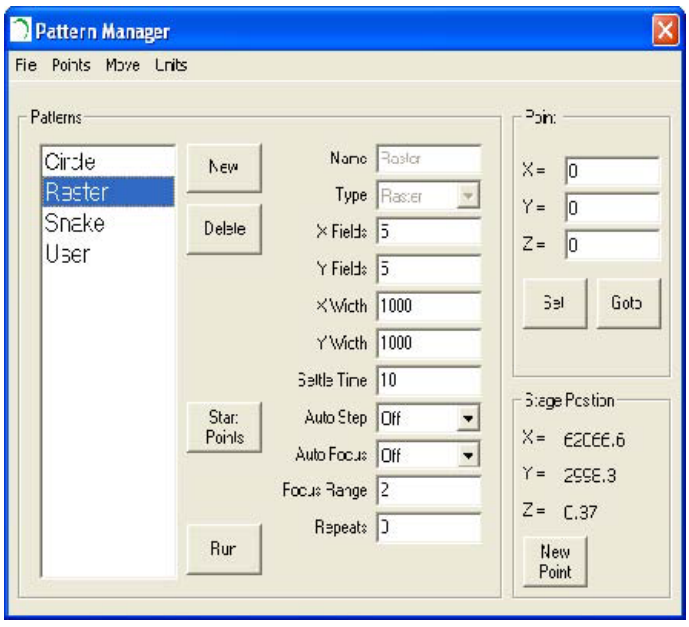
Setup the characteristic of the pattern:

Circle:



Select the diameter of the circle, the X width Y width the (FOV) fields of view, in microns
The settle time is the number of ms the stage will remain at each point.
Autostep: will automatically move to the next point after the settle time is complete, select off to manually click though the points.
Autofocus: the function is not available. Focus Range: the function is not available.
Repeats: The number of times the pattern should be repeated.

Raster:



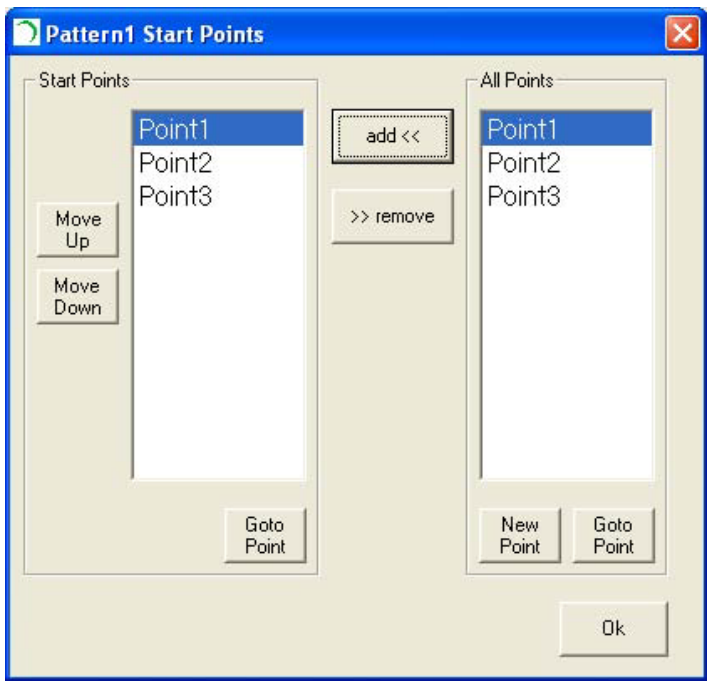
Select the number of X Fields and Y Fields.
Select the X width Y width the (FOV) fields of view, in microns.
The settle time is the number of ms the stage will remain at each point.
Autostep: will automatically move to the next point after the settle time is complete, select off to manually click though the points.
Autofocus: the function is not available. Focus Range: the function is not available.
Repeats: The number of times the pattern should be repeated.

Snake: The Snake has the same characteristic as the Raster above.

Adding start points to Snake Raster and Circle patterns:

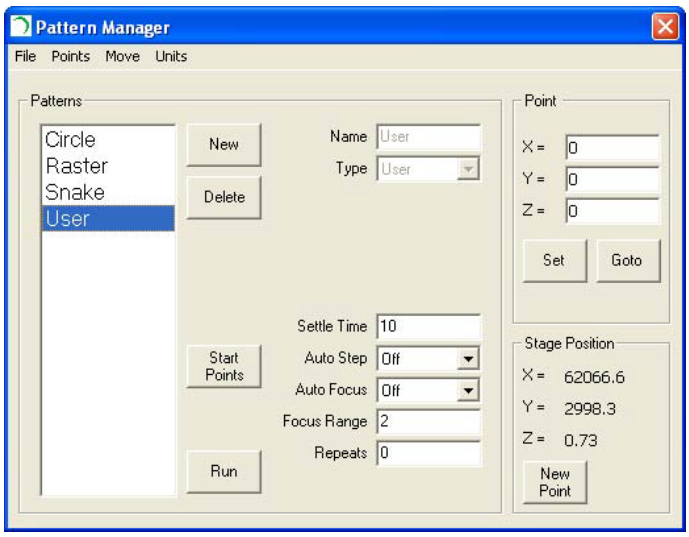
Every time the pattern is run it will start at the start point, if no start point is set the pattern will run from the current position.

Move to the start point and click new point.
Name the point and click ok.
Click Start points



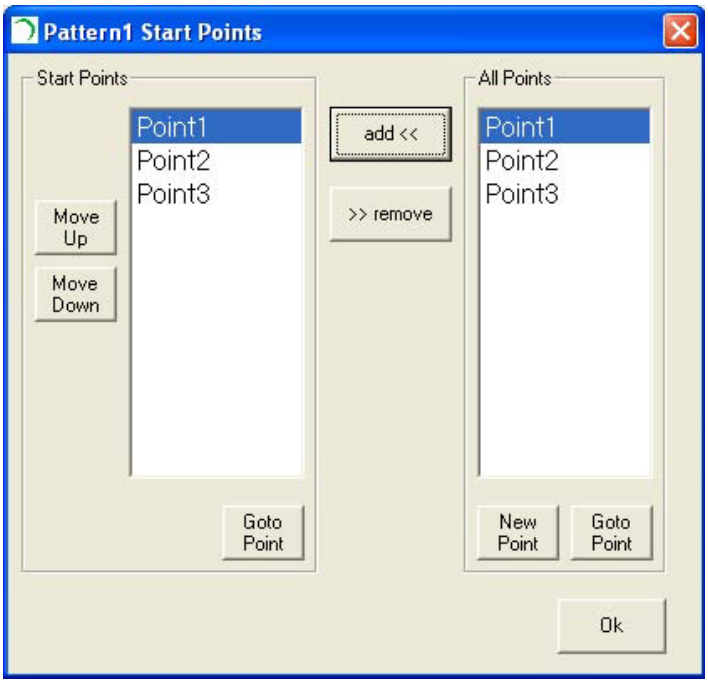
Move the named point to Start points.
Click OK.

User:



The settle time is the number of ms the stage will remain at each point.
Autostep: will automatically move to the next point after the settle time is complete, select off to manually click though the points.
Autofocus: the function is not available. Focus Range: the function is not available.
Repeats: The number of times the pattern should be repeated.

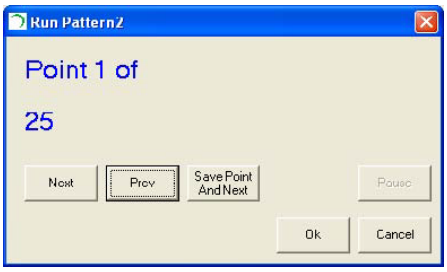
For the User pattern you must now add the points. Move the location of a point you require for the user pattern and click New Point.
Give the point a name and click ok.
Repeat this for each user point.
Click Start Points



Add the points and order them in the pattern required. You can add or remove points from the User pattern. Only point in the Start points will be used in the pattern.

Click OK once complete.

On all patterns Now Click Run.



If auto step off click Next to move through the positions.
If autostep on click next to start pattern.
Click Save Point and next to store the current point.

When exiting you will be prompted to save any unsaved patterns.

To enable the TTL pulse on pattern move or to have a TTL signal while the stage is moving see the TTL section above.

Section 5 Advanced Software Commands

5.1 ASCII commands for RS232 or Virtual COM control

ProScan controllers can accept commands from either serial port. The port defaults to a baud rate of 9600. This can be increased to 112400 if desired (see BAUD below).
Commands and controller responses are terminated with a Carriage Return code <CR> with the exceptions of 'I', 'K', and '#' in compatibility mode.
Commands are separated from arguments by one or more of the following delimiters.

- COMMA
- SPACE
- TAB
- EQUALS
- SEMICOLON
- COLON

To move a stage to a position of (100,200) the user could enter any of the following

G,100,200<CR>
G 100 200<CR>
G 100 200<CR>
G, 100, 200<CR>
G,,100,200<CR>

There are two modes of operation; Standard Mode and Compatibility Mode. Standard mode is the recommended mode for new software as it offers more features.

Compatibility mode is supported for existing customers who do not wish to re-port their existing application code. All communication is non-blocking meaning that commands can always be sent even though there may be a delay prior to their execution.
In Standard Mode up to 100 commands may be queued in the serial buffer of the controller. If a command is sent and there is insufficient space to accept it an error (E18 – Queue Full) will be returned. This indicates that the command has not been accepted and must be resent when the queue is no longer full. It is desirable to read back each command (R<cr>) before sending any further commands. Sending I<cr> aborts the current move and empties the queue.
The default convention is that the controller will move each device by 1um per number entered, in other words a requested move of 1000,0 will result in the stage moving 1mm in the X axis. If desired this can be over-ridden by using the scale stage (SS) command. If the stage scale is changed the resultant movements are determined by the model of stage in use. The controller is fixed at 250 micro-steps per full motor revolution and by setting SS,1 each requested move will be in micro-steps. A requested move of 1000,0 will now result in the stage moving by 4 (1000/250) complete motor revolutions. The actual distance moved by the stage will depend upon the pitch of the ball screw fitted to the stage. A stage with a 2mm ball screw pitch will move 8mm in the X axis while a unit with 5mm pitch screws would move 20mm.

The commands STAGE, FILTER, FOCUS and SHUTTER return a text description the last line of which is always "END". The allows Prior to add supplementary text information without resulting in changes to the users application code (assuming that the application software reads al text up to "END".)

Macro and Soak MACRO - a set of commands can be entered and started in a block by the use of the MACRO command.

Example of MACRO
If you wish to close a shutter, move the filter wheel to a new position then open the shutter.

MACRO	0	enter macro mode
8,A,1	R	close shutter A
7,1,4	R	move to filter position 4
8,A,0	R	open shutter A
WAIT 1000	R	wait 1000 msecs

MACRO 0 start the macro
SOAK - this is an extension to the MACRO command enabling the testing of a controller without tying up a PC. The soak routine continually performs the instructions entered in a loop, reporting the number of complete cycles on each pass. To stop the soak test enter an action and the unit will complete the current cycle and then stop.

Example of SOAK If you wish to test a shutter, and filter wheel you could use the following routine.

SOAK	0	enter soak mode
8,A,1	R	close shutter A
7,1,4	R	move to filter position 4
WAIT	500	wait 500msecs
8,A,0	R	open shutter A
7,1,1	R	move to filter position 1
SOAK	0	start the soak

Note MACRO and SOAK can only be used in Standard Mode (COMP,0)

5.2 General Commands

Command	Arguments	Response	Description
ERRORSTAT	None	Text String	Reports any errors with the system. The final line of information is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines in until the END is seen. Responses: "NONE" : No Error " AXIS 1 COMMS FAILED" : Communications failure with axis n. "AXIS 1 DRIVE FAILED" : Drive chip on axis n has failed. n is the axis number 1= X 2=Y 3=Z, 4=F1,5=F2,6=F3. Axis 7-9 are used by LumenPro systems.
?	None	Text string	Reports information about the peripherals currently connected to the controller. e.g. DRIVE CHIPS 10011 means Z and 4th axis chips missing, SHUTTERS = 110 means shutter 1 not connected. The final line of information is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines in until the END is seen. A typical response is shown below: PROSCAN INFORMATION DSP_1 IS 4-AXIS STEPPER VERSION 2.7 DSP_2 IS 2-AXIS STEPPER VERSION 2.7 DRIVE CHIPS 010111 (F2 F1 A Z Y X) 0 = Not Fitted JOYSTICK ACTIVE STAGE = H101/2 FOCUS = NORMAL FILTER_1 = NONE FILTER_2 = HF110-10 SHUTTERS = 001 (S3 S2 S1) 0 = Not Fitted AUTOFOCUS = FITTED VIDEO = NONE END

=	None	Nm	Reports whether any limit switch has been hit since the last call of the command. Nm is a two digit Hex number (one Byte) which converted to binary is as follows:- D07 D06 D05 D04 D03 D02 D0 D00 -4th +4th -Z +Z -Y +Y -X +X eg 05 means +Y and +X have been hit. Reading this status clears it.

Command	Argumen ts	Response	Description
$	[a]	Decimal number	Reports status as a decimal number and gives motion status of any axis of the controller. After binary conversion convention is as follows:- F2 F1 A Z Y X D05 D04 D03 D02 D01 D00 Optional parameters "$,a" where a is the axis or resource X - X axis Y - Y axis S - X and Y axis Z - Z axis A - A axis (not present on Optiscan) F - Filter wheels F1 - Filter wheel 1 F2 - Filter wheel 2 when the optional parameter is used the binary word is just for the axis requested. Stage is for x, y axis, F is for filters and would return 0 to 3 depending on if they are in use.
BAUD	b	0	Sets the baud rate of the port issuing the command to the value specified by b. As a protection measure, if no command is sent to the port while the controller is switched on, the baud rate will revert to 9600 after switching off and back on again twice. Allowable values for baud rate are 9600 (argument 96), 19200 (argument 19) and 38400 (argument 38) **WARNING** If the baud rate of ProScan is changed it is important for the application software to check communication with ProScan by scanning the baud rate on initialisation. This will avoid a permanent communication failure should the PC Port and ProScan port be set at different bauds.
COMP	None	0 = Std 1 = Comp	Report the Command protocol (Compatibility mode (1) or Standard mode (0))

Command	Argumen ts	Response	Description
COMP	m	0	Sets the controller compatibility mode for users who want to wait for 'R' at the end of the move. Compatibility is on if m = 1 and off if m = 0. Setting COMP,1 will result in less flexibility. For example, SOAK cannot be used and commands sent while the joystick is active will be lost. Compatibility mode is offered for users who wish the Commands to be compatible with earlier H127/H128 Prior Controllers.
DATE	None	Text string	Reports Instrument name, version number and compile time. Note that the system description refers to the presence or absence of internal drivers NOT which peripherals are connected. E.g H29XY1 can drive XY stage and 1 filter wheel only.
ERROR	h	0	Sets the reporting of error to 'Human' if h is 1 (readable text) else error codes are returned (see Error Description Table)
I	None	R	Stops movement in a controlled manner to reduce the risk of losing position. In compatibility mode this command is acted on immediately i.e. there is no need for a <CR>. The command queue is also emptied. In Standard Mode a <CR> must be used.
K	None	R	Immediately stops movement in all axes. Mechanical inertia may result in the system continuing to move for a short period after the command is received. In this case, the controller position and mechanical position will no longer agree. In compatibility mode this command is acted on immediately i.e. there is no need for a <CR>. The command queue is also emptied. In Standard Mode a <CR> must be used. This command is normally treated as an emergency stop.
MACRO	None	0	Used to enter and leave the Macro Mode. ONLY AVAILABLE IN STANDARD MODE.
SERIAL	None	nnnnn	Reports the units' serial number nnnnn, if the serial number has not been set "00000" is returned.

Command	Argument s	Response	Description
LMT	None	Nm	Reports whether any limit switch is currently active. A limit switch is active if the switch is in contact with the axis hardware. Nm is a two digit Hex number (one Byte) which when converted to binary is as follows:- D07 D06 D05 D04 D03 D02 D01 D00 -4th +4th -Z +Z -Y +Y -X +X eg 05 means stage is in contact with +X and +Y limit switches, 0A indicates contact with both -X and –Y limits. 00 means all axes are not in contact with any limit switch. (Note that the controller knows whether the limit switch is normally low or normally high and corrects accordingly. This does not return the hardware signal level of the limit switch (see STAGE command).
SOAK	None	0	Used to soak test the controller and peripherals. ONLY AVAILABLE IN STANDARD MODE.
VERSION	None	ddd	Reports the units software version number as a 3 figure number eg 100 is Version 1.00
WAIT	t	0	Inserts a wait of t milliseconds in a macro/soak routine.

5.3 Stage Commands

Command	Argument s	Response	Description
B	None	R	Moves Back by v steps as defined by the 'X' command below.
B	y	R	Moves Back by y steps.
BLSH	s,b	0	Sets the stage backlash value for stage move commands sent via the serial port (not joystick moves) to b. s = 1 enables backlash s = 0 disables backlash. B is a number of microsteps of the motor. There are 50,000 microsteps per revolution of the motor on a standard ProScan system.
BLSH	s	0	Enables / Disables the Stage (XY) backlash. S = 1 enables backlash s=0 disables backlash.
BLSH	None	s,b	Reports back s and b values for stage moves sent via the serial port (see above). In COMP 1 mode only s returned.
BLSJ	s,b	0	Sets the stage backlash value for joystick moves to b in microsteps. s = 1 enables backlash s = 0 disables backlash.
BLSJ	s	0	Enables / Disables the stage backlash for joystick moves. S = 1 enables backlash s = 0 disables backlash.
BLSJ	None	s,b	Reports back s and b for Stage (see above). In COMP 1 mode only s returned
F	None	R	Moves Forward by the v step size defined by the 'X' command
F	y	R	Moves Forward by y steps.
G	x, y, z	R	Go to the absolute position x, y, z. Z is optional.
GR	x, y,z	R	(Go Relative) Moves by the amount specified by x, y, z. Z is optional.
GX	x	R	Move to absolute position x (y position remains unchanged)
GY	y	R	Move to absolute position y (x position remains unchanged)
H	None	0	Turns OFF the joystick (Stage and Z axes) after completion of any current joystick move. The joystick is re-enabled using 'J' Command (see below) The joystick is always enabled on power up.
J	None	0	Turns ON the joystick (Stage and Z axes). This command is acted upon immediately.

Command	Argument s	Response	Description
JXD	c	0	Sets the direction of X axis under joystick control. c = 1 Joystick right, moves stage mechanically right c = -1 Joystick right, moves stage mechanically left.
JXD	None	c	Reads c.
JYD	d	0	Sets the direction of Y axis under joystick control c = 1 Joystick forward, moves stage mechanically forward. c = -1 Joystick forward, moves stage mechanically back.
JYD	None	d	Reads d.
L	None	R	Moves Left by u steps as defined by the 'X' command.
L	x	R	Moves Left by x steps.
M	None	R	Moves stage and focus to zero (0,0,0)
O	s	0	Sets the speed of the stage under joystick control. s is percentage in range 1 to 100.
O	None	s	Reports value of O allowing for joystick speed buttons effect (if the button speed is ½ and O is set to 50 the returned value will be 25)
P	None	x,y,z	Reports absolute position of x,y and z axes. This can be used whilst any axis is moving to give 'position on the fly' Note <CR> (Carriage return) only will also return position.
P	x, y, z	0	Sets absolute position of x, y, and z axis. No axis can be moving for this command to work. If there is a linear encoder fitted on the Z axis the position can only be set when the current position is within the encoder range and it has previously been at some lower position. If neither of these conditions has been met an error will be reported.

Command	Argument s	Response	Description
PS	None	x,y	Reports position of Stage only (x, and y).
PS	x, y	0	Sets Absolute position of x, and y axis. No axis can be moving for this command to work.
PX	None	x	Reports position of x only.
PX	x	0	Sets Absolute position of x axis. No axis can be moving for this command to work.
PY	None	y	Reports position of y only.
PY	y	0	Sets Absolute position of y axis. No axis can be moving for this command to work.
R	None	R	Moves Right by u steps as defined by 'X' command.
R	x	R	Moves Right by x steps.
RES	s,r		Sets the desired resolution for the stage, s is X and Y axes, r can be a non integer number setting the resolution for the axis in units of microns. e.g. RES,s,1.0 Resolution set to 1.0 micron
RES	a		Returns resolution for axis a.
RIS		R	Restore Index of Stage. This command is only effective if the SIS command has been used on installation. This Command can be used at any time and will re synchronise the stage and controller position should the stage have been manually moved when the controller was off. The stage will hit limits and then return to the position stored by the controller prior to the last power down. If the stage has not been manually moved this command will not normally be needed.

Command	Argument s	Response	Description
SAS	a	0	Sets the maximum stage acceleration to a. Range is 1 to 100.
SAS	None	a	Report current stage acceleration
SCS	c	0	Sets the current stage S-curve value. This is the rate of change of acceleration during the transition from stationary until the stage reaches the full acceleration set by SAS. Range of c is 1 to 100.
SCS	None	c	Report current stage S-curve setting.
SIS		R	Set Index of Stage. This command would normally only be used on first installation of the system. The stage moves to limits and sets absolute position to 0,0. The controller will always remember this internally as zero even with subsequent uses of Z and P, x , y command.
SMS	m	0	Sets the current Stage (x, y) maximum speed to m. Range is 1 to 100.
SMS	None	m	Report the current Stage (x, y) maximum speed setting m
SMS,i	None	n	n=number of pulse per second the stage current stage speed is set to.
SMS,n,i	n	0	Sets the current stage speed to n. n is the number of pulses per second.
STAGE	None	Text string	Prints information about the currently connected stage. There are 250 microsteps per full step of the motor. The final line of information is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines in until the END is seen. Example STAGE = H101/2 TYPE = 1 SIZE_X = 108 MM SIZE_Y = 71 MM MICROSTEPS/MICRON = 25 LIMITS = NORMALLY CLOSED END
SKEW	None	a	Returns the skew angle a, in degrees, that had previously been set by the SKEW,A and SKEW,S commands or the SKEW,A command.

Command	Argument s	Response	Description
SKEW	A	0	Skew About command, when used in conjunction with SWEW S, can re-align samples which are not perfectly aligned to the XY motion of the stage. Use this command to skew the XY stage movement About this point. The SKEW S command must also be executed to complete this operation.
SKEW	S	0	Use this command after the SKEW A command AND moving a distance in X and Y axis to define the skew angle. This is equivalent to twisting the stage.
SKEW	a	0	Sets the skew angle a. IE SKEW 0.5 will skew the stage through 0.5 degrees. SKEW 0 disables skew function
TYA	None	0	Toggles Y axis of joystick between Y and A axis control
VS	x,y,u		Sets the stage speed to x, y for the X and Y axes respectively in units specified by u. u = values in microns linear travel per second. This is default if u is omitted, therefore VS,500,500 would set 500um/s in both X & Y. u = p are values in microsteps per second based on 250 microsteps per full step of motor. VS,500,500,p would set 2 full steps per second. To stop this 'virtual joystick' move use VS,0,0. If limits are hit the speed will be set to zero for the appropriate axis.
X	None	u,v	Reports the current step size (u and v) in x and y for the stage
X	u,v	0	Sets the current step size for the stage.
XD	C	0	Sets the direction of the X axis move (mechanical) with respect to the software move. Use this command if 'L' command moves stage mechanically right. C=1 or –1.
YD	C	0	Sets the direction of the Y axis move (mechanical) with respect to the software move. Use this command if 'F' command moves the stage mechanically backwards. C=1 or –1.
Z	None	0	Sets the stage and focus position to ZERO (0,0,0).

5.4 Z-Axis Commands

Command	Argument s	Response	Description
GZ	z	R	Move to absolute position z
BLZH	s,b	0	Sets the z-axis backlash value for z-axis move commands sent via the serial port (not joystick moves) to b. s = 1 enables backlash s = 0 disables backlash. b is the number of microsteps per motor. There are 50,000 microsteps per revolution of the motor on a standard ProScan system.
BLZH	s	0	Enables / Disables the z-axis backlash. s = 1 enables backlash s = 0 disables backlash.
BLZH	None	s,b	Reports back s and b values for z-axis moves sent via the serial port (see above). In compatibility mode only s returned
BLZJ	s,b	0	Sets the z-axis backlash value for joystick/digipot moves to b in microsteps. s = 1 enables backlash s = 0 disables backlash.
BLZJ	s	0	Enables / Disables the z-axis backlash for joystick/digipot control. s = 1 enables backlash s = 0 disables backlash.
BLZJ	None	s,b	Reports s and b values for z-axis (see above). In compatibility mode only s returned
C	None	w	Reports the current step size for the z-axis focus motor.
C	w	0	Sets the current step size for the z-axis focus motor to w.
D	z	R	Moves down by z steps.
D	None	R	Moves down w steps defined by the 'C' command.
FOCUS	None	Text string	Prints information about z-axis focus unit. There are 250 microsteps per full step. The information end is always a line saying END. This allows for the addition of extra fields of information without affecting application software. Users should always read lines in until the END is seen to keep in sync. Example FOCUS = NORMAL TYPE = 0 MICRONS/REV = 100 END

Command	Argument s	Response	Description
H	None	0	Turns OFF the joystick (Stage and Z axes) after completion of any current joystick move. Joystick is re-enabled using 'J' Command below. The joystick is always enabled on power up.
I	None	R	Stops movement in a controlled manner to reduce the risk of losing position. In compatibility mode this command is acted on immediately i.e. there is no need for a <CR>. The command queue is also emptied. In Standard Mode a <CR> must be used.
J	None	0	Turns ON the joystick. (Stage and Z axes) This command is acted upon immediately.
JZD	d	0	Sets the direction of Z axis under digipot control. d = 1 or -1.
JZD	None	d	Reads d.
K	None	R	Immediately stops movement in all axes. Mechanical inertia may result in the system continuing to move for a short period after the command is received. In this case, the controller position and mechanical position will no longer agree. In compatibility mode this command is acted on immediately i.e. there is no need for a <CR>. The command Queue is also emptied. In Standard Mode a <CR> must be used. This command is normally treated as an emergency stop.
M	None	R	Moves stage and focus to zero (0,0,0)
OF	S	0	Sets the speed of the focus motor under joystick/digipot control. s is percentage in range 1 to 100.
OF	None	S	Reports value of OF allowing for joystick speed buttons effect (if the button speed is ½ and OF is set to 50 the returned value will be 25)
PZ	None	Z	Reports position of z only.
PZ	z	0	Sets absolute position of z axis. No axis can be moving for this command to work. If an encoder is present on the Z axis, the position is only set when the current position is in the encoder range (it must have been further down than it is currently).

Command	Argument s	Response	Description
RES	a,r		Sets the desired resolution for the axis. a is the axis, r can be a non-integer number setting the resolution for the axis in units of microns. UPR command must be implemented before using this command for Z axis. e.g UPR,z,400 RES,z,0.1 Resolution set to 0.1 micron for a focus mechanism of 400 microns per revolution of the motor.
RES	a		Returns resolution for axis a.
SAZ	a	0	Sets the current Z acceleration to a. Range is 1 to 100
SAZ	None	a	Report the current Z acceleration setting.
SCZ	c	0	Sets the s-curve value for Z in units of % in the range 1 to 100.
SCZ	None	c	Returns the s-curve value.
SMZ	None	m	Report the current Z maximum speed setting m
SMZ	m	0	Sets the current Z maximum speed to m. Range is 1 to 100
U	z	R	Moves Up by z steps.
U	None	R	Moves Up by w steps defined by the 'C' command.
UPR	a,n	0	Sets the number of microns (n) linear movement per revolution of the motor for the axis a. E.g. UPR,z,100 is set for a motor fitted to the fine focus knob with 100 microns focus movement per revolution.
UPR	a	n	Returns microns per revolution for the axis a.
V	z	R	Go to the absolute position z in the z-axis.

Command	Argument s	Response	Description
VZ	s,u	R	Sets the focus speed to s in units specified by u. u = u Units are microns per second. u is the default unit and can be omitted. To stop a virtual focus move use VZ,0 Note that UPR must be set to achieve correct linear focus speed.
Z	None	0	Sets the stage and focus absolute position to zero (0,0,0).
ZD	d	0	d=1 Sets direction of rotation of focus motor for commands sent via serial port. Defaults to 1 and is correct for motor fitted on right hand side of the microscope. d=-1 Direction of rotation of focus motor opposite to above.
ZD	None	d	Returns d

5.5 Filter Wheel Commands

Command	Argument s	Response	Description
7	w, f	R or a number. If no wheel is fitted E,17 will be returned.	w defines the filter wheel number 1,2 or3. f is defined below. If f is a number, command moves filter wheel w to filter position f. If f is 'N', command moves filter wheel w to next filter. If f is 'P', command moves filter wheel w to previous filter. If f is 'F', command reports current filter position on filter wheel w. If f is 'H', command performs a home routine. If f is 'A' wheel will auto home on controller startup If f is 'D' wheel will NOT auto home on startup (default)
7	0,f1,f2,f3	R	The first parameter (zero) indicates all filters; the three subsequent parameters f1 f2 and f3 are the target positions for filter1, 2 and 3 respectively. Filters not fitted or invalid filter wheel positions are ignored. This feature is only available in COMP 0 mode.
7	C	0	Enables automatic shutter closure during any filter move and then re-assert initial shutter state at end of move
7	D	0	Disables automatic shutter closure
7	W,T,P	Text	Displays tag text for filter wheel w at position p. 7,1,T,3 will respond with text for filter wheel 1 position 3.
7	W,T,P, text	R	Writes text to memory for filter wheel W and Position P. 7,1,T,3,Dapi will set the tag for filter wheel 1 position 3 to "Dapi" Tags are 6 characters log and are displayed in control centre display.

FILTER	w	Text string	Prints information about filter wheel w. The information end is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines in until the END is seen in order to maintain compatibility. Example FILTER_1 = HF110-10 TYPE = 3 PULSES PER REV = 67200 FILTERS PER WHEEL = 10 OFFSET = 10080 HOME AT STARTUP = TRUE SHUTTERS CLOSED = FALSE END
FPW	w	n	Reports the number of filter positions for filter wheel w.

Command	Argument s	Response	Description
SAF	w	a	Report the current filter wheel w acceleration setting.
SAF	w, a	0	Sets the current filter wheel w, acceleration to a in units of % Range is 1 to 100
SCF	w,c		Sets the current filter wheel w S-Curve setting. Range is 1 to 100
SCF	w	c	Report the current filter wheel w S-Curve setting c
SMF	w	m	Report the current filter wheel w maximum speed setting m
SMF	w, m	0	Sets the current filter wheel w maximum speed to m in units of %. Range is 1 to 100

5.6 Shutter Commands

Command	Argument s	Response	Description
8	s,c[,t]	R If shutter s is not fitted E,20 will be returned	Opens or closes the shutter s (value '1' '2' or '3'), if c is 0 the shutter is opened, 1 it is closed. The optional argument t is used to open/close the shutter for a time t milliseconds.
8	0,s1,s2,s3	0	First parameter is a zero. Subsequent parameters define the startup state of shutters s1,s2 and s3 respectively. if s1 is 0 then shutter1 is opened, 1 it is closed etc. Default state is all shutters closed.
8	s	c If shutter s is not fitted E,20 will be returned	Returns status c of shutter s
Shutter	s	Text string	Prints information about shutter's' (s is a value between 1 and 3). The information end is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines until the END is seen in order to maintain compatibility. Example SHUTTER_1 = NORMAL DEFAULT_STATE=CLOSED END

5.7 Lumen Pro Commands

Command	Arguments	Response	Description
LIGHT		a	Reports the output of light from the shutter in %. The command automatically locates LGG_SHUTTER. Error 20 reported if no shutter detected.
LIGHT	n	0	Sets the output from the shutter to n, where n can be set between 1-100%. The command automatically locates LGG_SHUTTER. If n is "h" the shutter will perform a home routine.
LIGHT	P,n	0	Sets the filter wheel position P to n % light output. i.e., LIGHT,4,45 Sets position 4 to 45% light output. Use 7,n,4 to move filter to position 4, where n is the Filter Wheel port which the shutter is attached. STANDARD 10 Position Shutter settings are: Position % Light output 0,11, 22, 33, 44, 55, 66, 77, 88, 100
LIGHT	P, ?	n	Reports n, the %output of position p.
7	W,T,P	Text	Displays tag text for filter wheel w at position p. 7,1,T,3 will respond with text for filter wheel 1 position 3.
7	W,T,P, text	R	Writes text to memory for filter wheel W and Position P. 7,1,T,3,Dapi will set the tag for filter wheel 1 position 3 to "Dapi" Tags are 6 characters log and are displayed in control centre display.
LIGHT	POWER , n	R	Switches on or off the Lumen 200PRO unit, if n is 1 the unit is on, 0 it is off, e.g. "LIGHT, POWER, 0" would switch the unit off. Sending "LIGHT, POWER" without 0 or 1 will report the current status. The Lumen 200PRO unit must be connected to the plug and play shutter output of a ProScanII, PCI or OptiScanII controller for this function to operate. The Lumen will default to state 1, Lumen on, if no cable connected.

5.8 Pattern Commands

These commands control the internal patterns available in the ProScan controller Firmware.

Command	Arguments	Response	Description
E	None	R	Sets the origin for the pattern to the current position. Zeros the pattern X and Y counter.
E	b	0	If b = 0 the stage returns to the origin after completing the final move of the pattern (default setting upon power up). If b = 1 the stage will stay at the final pattern position.
N	n,m	0	Defines the number n of X and number m of Y steps for the pattern.
N	None	n,m	Reports number of X and Y steps.
S	None	R	Move to next position in Rectangular Raster.
S	?	s	Step number of scan.
S	n,m	R	Moves to nth cell in X and mth cell in Y in rectangular raster.
X	x,y	0	Sets the step size in X and Y
X	None	x,y	Reports step size in X and Y.
Y	None	R	Move to next position of Rectangular Snake.
Y	?	s	Step number of scan.
Y	n,m	R	Moves to nth cell in X and mth cell in Y in rectangular snake.
Q	None	0	Sets the origin of the disc grid equal to the current position. Zeros the disc grid X and Y counter.
T	None	R	Move to next field of Disc Raster Scan.
T	?	s	Step number s of circular scan
W	d	0 in compatibi l ity mode. Number of fields in standard mode.	Sets the diameter in mm of a circular disc (Range 1 to 327mm). The parameter X defining the step sizes in x and y should be defined before setting the W value.
W	None	d	Reports the disc diameter (in mm.)

5.9 H127/H128 Compatible Commands

The following commands are also available. There are equivalent commands listed earlier to perform the same function. The commands below provide compatibility with previous generations of Prior Controllers H127/H128.

Command	Arguments	Response	Description
#	None	bit field	Reports the current state of the controller. Returns bit field giving current status of controller 0 = idle, 1 = busy. Format is F2 F1 A Z Y X eg 100000 is filter wheel 2 moving only 000111 is stage and focus moving. This command is acted on immediately in compatibility mode there is no need for a <CR>.
=	None	N<LF>	Limit switch status (see Main Command section above for description.) Note the addition of Line Feed<LF> before <CR>
10	None	0<LF>	0<LF> indicates no AutoFocus fitted (only available with ProScan) Note the addition of Line Feed <LF> before <CR>
2D	n		Starts move of relative magnitude n Down at speed set by 3Z
2E	n		Starts move of relative magnitude n East (Right) at speed set by 3X. Move can be interrupted using the 'I' Command.
2N	n		Starts move of relative magnitude n North (Back) at speed set by 3Y
2S	n		Starts move of relative magnitude n South (Forward) at speed set by 3Y
2U	n		Starts move of relative magnitude n Up at speed set by 3Z
2W	n		Starts move of relative magnitude n West (Left) at speed set by 3X
3X	p		Sets the X speed (as a percentage of maximum) for use with 2E and 2W commands.
3Y	p		Sets the Y speed (as a percentage of maximum) for use with 2N and 2S commands.
3Z	p		Sets the Z speed (as a percentage of maximum) for use with 2U and 2D commands.
9	x,y,z	0	Sets the Absolute position of x,y and z Axis. (See P,x,y,z.)

Command	Arguments	Response	Description
AFS	None	0	AutoFocus score. A value zero is returned if Autofocus is not implemented.
CC	d, r, s		
FS		None	Focus Score.<CR> only is returned if AutoFocus not implemented.
G3	x,y,z	R	Move to absolute position x,y,z. (See G,x,y,z.)
H	None		Turns OFF the joystick after completion of any current joystick move. This function responds with a "0" in Standard mode and a "R" in Compatibility mode. (See J,0)
I (no<CR>)	None	R when motors stopped (if motors moving) No response at all if motors already stationary .	Stops stage gracefully.
J	None		Turns ON the joystick. This function responds with a "0" in standard mode and a "R" in compatibility mode.(See J,1)
RP			Same as RIS (Restores Index of Stage)
SAZ	a		Sets the current Z acceleration setting a.(See SAZ)
SAZ	None		Report the current acceleration setting a for Z
SAZ	a		Sets the current Z acceleration to a. Range is 4 to 100 (See SAZ)
SMX	s	0	Sets the current (x, y) maximum speed to s. Range is 1 to 100
SMX	None	S	Report the current (x, y) maximum speed setting s (See SMS)
SMX	s	0	Sets the current (x, y) maximum speed to s. Range is 1 to 100
SRF	w		Report the current filter wheel w acceleration setting
SRF	w, a		Sets the current filter wheel w, acceleration to a. Range is 4 to 100
SRF	w, a		Sets the current filter wheel w, acceleration to a. Range is 4 to 100 (See SAF)
SRX	a		Sets the current Stage (x, y) acceleration to a. Range is 4 to 100 (See SAS)
SRZ			Same as SIS (Sets Index of stage)

Command	Argume nts	Response	Description
SS	s	0	Sets the value for XY user units to s Entering negative number reverses direction of stage.
SSZ	None	S	Reports the Z user units value s
SSZ	s	0	Sets the value for Z user units to s. Entering negative number reverses direction of motor.
XYBL	s,b		Sets the XY backlash value for joystick to b in pulses (250 pulses per full step of the motor). s = 1 enables backlash s=0 disables backlash.
XYBL	None		Reports back s and b for stage (see above) in form s,b
XYBLPC	s,b		Sets the XY backlash value for host moves to b in pulses.s = 1 enables backlash s=0 disables backlash (See BLSH)
XYBLPC	None		Reports back the XY backlash for host moves in form s,b (See BLSH)
ZBL	s,b		Sets the Z backlash value for joystick/digipot to b in pulses s = 1 enables backlash s=0 disables backlash.
ZBL	None		Reports back s and b for Z axis (see above) in form s,b
ZBLPC	s,b		Sets the Z backlash value for host moves to b in pulses. s = 1 enables backlash s=0 disables backlash (See BLZH)
ZBLPC	None		Reports back the Z backlash value for host moves in form s,b (See BLZH)

5.10 Error Codes and Error Tracking Commands

To track physical errors in the ProScan III use the following command.

Command	Arguments	Response	Description
ERRORSTAT	None	Text String	Reports any errors with the system. The final line of information is always a line saying END. This allows for the addition of extra fields of information without effecting application software. Users should always read lines in until the END is seen. Responses: "NONE" : No Error " AXIS 1 COMMS FAILED" : Communications failure with axis n. " AXIS 1 DRIVE FAILED" : Drive chip on axis n has failed. n is the axis number 1= X 2=Y 3=Z, 4=F1,5=F2,6=F3. Axis 7-9 are used by LumenPro systems.

If a command is not valid a response of "E,n" is returned. The n specifies an error type as listed below. Machine or human readable messages are chosen using the ERROR Command.

ERROR CODE	**ERROR DESCRIPTION**
1	NO STAGE
2	NOT IDLE
3	NO DRIVE
4	STRING PARSE
5	COMMAND NOT FOUND
6	INVALID SHUTTER
7	NO FOCUS
8	VALUE OUT OF RANGE
9	INVALID WHEEL
10	ARG1 OUT OF RANGE
11	ARG2 OUT OF RANGE
12	ARG3 OUT OF RANGE
13	ARG4 OUT OF RANGE
14	ARG5 OUT OF RANGE
15	ARG6 OUT OF RANGE
16	INCORRECT STATE

17	WHEEL NOT FITTED
18	QUEUE FULL
19	COMPATIBILITY MODE SET
20	SHUTTER NOT FITTED
21	INVALID CHECKSUM
60	ENCODER ERROR
61	ENCODER RUN OFF

5.11 CS152 (Joystick Configuration backwards compatibility)

These commands are only applicable to CS152 Joysticks and not for the PS3J100 Interactive Control Centre.

The CS152 range of joysticks is compatible with the ProScan system and any one can be used depending on the system configuration as follows;

CS152Z	Z only digipot
CS152V2	2 axis joystick
CS152V3	3 axis joystick
CS152DP	2 axis joystick with digipot for Z axis.
CS152EF	2 axis joystick with digipot for Z axis with 'fire' button.

The CS152Z is used for the control of a system equipped with only a Z-axis. It has a large round digipot control which provides fine control of the focus motor. A button is provided to change the focus motor speed range and there are two further buttons which can be used for coarse focus control by driving the focus up or down while the button is pressed.

Joysticks may be fitted with up to 3 buttons, 2 long 'hot keys' on either side of the joystick and a 'fire' button on top of the joystick. In addition, there are 2 small sliding buttons, one to the side and one below the joystick. These provide spring loaded tension to the joystick which ensures it always returns to its vertical 'off' position. Ensure these sliding buttons are fully home and the joystick is held vertically before turning the system on.

The joystick can be used to control the speed and direction of the stage. A small deflection of the joystick results in slow stage movement while a large deflection provides high speed movement. The direction of movement of the joystick normally produces a corresponding movement of the stage. For example, moving the joystick to the left will move the stage left. Please note however, that there are commands available to reverse the direction of the stage on one or both axes (see Advanced Operation).

The CS152DP and CS152EF joysticks are fitted with a round digipot control on the side of the joystick box. This is used for fine focus control. The digipot is a rotary encoder which comprises a disc with radial lines and 2 LED detectors. As the disc is rotated by the knob, the encoder generates two square wave signals. One controls the amount of movement while the other monitors the direction of movement. This provides precise positioning of the fine focus knob on the microscope while the system continuously keeps track of the actual position.

The ProScan controller offers a specific command which can be used to change the function of any of the buttons on the joystick.

The command has the following format:

Command	Arguments	Response (including <cr>)
BUTTON	b,f	0

There are 4 possible conditions identified by b

b=0 Button released.(i.e. changing to a state where no button is pressed)

b=1 Right button pressed

b=2 Left button pressed

b=3 *'Fire'* button pressed.(on top of joystick).

(Pressing more than one button simultaneously will not register a command.)

f defines what action the controller does when it first detects a new state given by b above.

f= 0 Default Button Function

f= 1 Z motor velocity stop (only used in conjunction with f=2 and f=3 below)

f= 2 Z motor constant velocity up

f= 3 Z motor constant velocity down.

f= 4 Toggles digipot speed 100% 50% 25%

f= 5 Toggles X/Y joystick speed 100%, 50%, 25%

f= 6 Toggles joystick speed 100% 10%

f= 7 Toggles joystick speed 100% 2%

f= 8 Moves Z motor up by amount defined by C Command

f= 9 Moves Z motor down by amount defined by C Command

f=10 Moves stage left defined by X Command

f=11 Moves stage right defined by X Command

f=12 Moves stage back defined by X Command

f=13 Moves stage front by amount defined by X Command

f=14 Toggles Digipot Speed 100% 10%

f=15 Toggles Digipot Speed 100% 2%

f=16 Starts Auto Focus

f=23 Next Point

f=24 Next Wafer

f=25 Smooth Stop (I)

f=26 Sudden Stop (K)

f=28 Toggle Shutter 1
f=29 Toggle Shutter 2
f=30 Toggle Shutter 3
f=35 assigns any following text to the button. Hence any command may be assignable to a button.

5.12 Examples for the CS152 Joystick Buttons

Right button (b=1) being pressed moves Z up at constant velocity
Left button (b=2) being pressed moves Z down at constant velocity
Release buttons (b=0) stops Z motor (no buttons being pressed)
BUTTON,1,2
BUTTON,2,3
BUTTON,0,1
BUTTON 1,35,TYA (assigns the TYA command to button 1)
BUTTON 1,35,G,100,200,300 (executes a G,100,200,300 command)

Right button (b=1) toggles joystick speed 100%-2% A momentary press of Left button (b=2) starts Z motor moving down with constant velocity.

Pressing 'Fire' button (b=3) stops Z motor.
BUTTON,1,7
BUTTON,2,3
BUTTON,3,1

Normal Joystick operation i.e.
Left button (b=2) toggles Stage speed 100% 50% 25%
Right button (b=1) toggles Z motor speed 100% 50% 25%
BUTTON,3,0
BUTTON,2,0
BUTTON,1,0
BUTTON,0,0
BUTTON,2,5
BUTTON,1,4
BUTTON,0,0

5.13 Add-on Trigger Board Commands

These commands are only available if the trigger board if fitted.

Command	Arguments	Response	Description

5.14 Encoders

Prior stages can be equipped with either linear or rotary encoders for higher positioning repeatability and accuracy.

A linear encoder is an optical system that reflects light off a graduated scale through a grating and onto photo sensors. These sensors generate electrical currents. The electrical currents generated are used to determine distance and direction the stage has travelled. Unlike rotary encoders which imply a distance travelled by measuring the rotation of the motor, linear encoders/scales are actually mounted to the moving plates of a stage and therefore directly measure stage movement.

Linear Encoders benefit the stage user by providing:

- The ability to use a Digital Read Out (DRO)
- The ability to provide closed loop "servo" control
- Superior precision and finer resolution.

Linear scales mounted on Prior stages now provide repeatability to +/- 0.3 microns and resolution (step size) as small as 0.1 microns. This superior performance is extremely critical in many Industrial and Bio-Science applications such as the performance of time-lapse photography studies.

H130 Controller with the 'E' option enables rotary or linear encoder with RS485 differential quadrature square wave outputs to be inputted to all or any of the 4 axes. This controller will have 3 or 4 round 12 pin connectors on the back of the control box labelled, "X Axis", "Y Axis", etc. Turn the controller off and plug in the appropriate encoder or scale that corresponds with the appropriate axis.

The linear scales also have a home or reference position. This is a specific mark on the scale that is read by the controller and it can be used to establish the same reference position at any time. To use this feature, see the commands SIS and RIS described below.

When an encoder is fitted and enabled (the default condition) the controller uses the position measured by the encoder as the true position and not the number of pulses sent to the stepper motor.

The controller will sense which encoder input has an encoder fitted. It will control the individual axis using motor pulses or encoder pulses depending on whether that axis has an encoder fitted (and enabled).

When the controller identifies an encoder fitted to any axis for the first power-up this prompts a small motion to be initiated (two full steps of the motor). The controller will use the number and sign of the counts from the encoder to establish the correct ratio between encoder pulses and motor pulses.

The stage can be sent to a position using internal stepper position or encoders using the ENCODER Command. If the stage is fitted with encoders which are disabled the 'P,s' and 'P,e' Command can be used to compare the stepper and encoder position. This facility may be useful for application software where stage calibration is required.

Stepper moves will be faster than moves under encoder control due to the feedback, checking, and adjusting required for the closed loop system.

The SERVO,b command gives the option for the controller to constantly read the encoder position (when stationary) and correct for any position drift.

b=1 SERVO on b=0
SERVO off.

This is a global command that affects all axes fitted with encoders.

With SERVO off, the axis still moves to its destination positions measured by the encoder but will not correct for any drift once the destination has been reached.

This command refers to **ALL** axes which have encoders fitted (and enabled)

Command	**Arguments**	**Response**	**Description**
ENCODER	none	n	Reports back as a decimal number the axes that are operating using the encoders. For example, 3 means X and Y axes are using the encoders.
ENCODER	b	0	b=0 Disables ALL encoders b=1 Enables ALL encoders.
ENCODER	Axis	0,1	Returns whether the individual axis have encoder enabled or disabled. Axis = S,X,Y,Z,A.
ENCODER	Axis,b	0	b=0 Disables encoder specified by Axis b=1 Enables encoder specified by Axis.
SENCODER	As above		Behaves like the ENCODER commands above except that it forces the encoder and motor positions to be the same when enabling and disabling encoder function.

Command	Arguments	Response	Description
ENCW	Axis,n	0	Sets the encoder window n for the Axis specified. This can prevent excessive 'hunting' as controller tries to close the position loop. Axis can be one of S, X, Y, Z, A
ENCW			Returns the allowable encoder as a set of four numbers for axis XYZA Ie. 0 0 0 0
SERVO	none	n	Reports back as a decimal number the axes that have servo operation enabled. For example, 4 means Z axis servo enabled, others disabled.
SERVO	b	0	b = 0 stage moves to destination position (as read from encoders) and stops. There is no servo action therefore the stage can drift from destination position due to external mechanical and thermal forces. b = 1 Stage continuously reads position from encoders (even when stationary) and corrects for any drift.
SERVO	Axis	0,1	Returns whether the individual axis have servo enabled or disabled. Axis = S,X,Y,Z,A
SERVO	Axis,b	0	b=0 Disables servo specified by Axis b=1 Enables servo specified by Axis.
SWS	n	o	Sets a window of n encoder counts about the current stage position to prevent excessive hunting when servo enabled.
SWZ	n	o	Sets a window of n encoder counts about the current Z position to prevent excessive hunting when servo enabled.
P	e	x,y,z	Argument 'e' indicates encoder position. If ENCODER,0 returns encoder position at present stepper position (Use P Command) If ENCODER,1 Returns encoder position. This is the same as 'P' Command
SIS	none	R	Set Index of stage. The stage will find the encoder Index signal, stop and set absolute position to 0,0 Used only when the mechanical position of the stage bears no relationship to controller position; i.e. when the stage has been mechanically moved during power off. THIS COMMAND MUST BE DONE ONCE AT INITIAL CONNECTION OF STAGE TO CONTROLLER IN ORDER TO ESTABLISH A UNIQUE REFERENCE POSITION WHICH IS PERMANENTLY REMEMBERED BY THE CONTROLLER.

Command	Arguments	Response	Description
RIS	none	R	Restore Index of Stage. Used to restore accurate mechanical position by seeking Index signal and returning back to controller position. This is used to re-establish mechanical accuracy by referencing back to the encoder index signal.

5.15 TTL input/output signals

The H130 controller has the capability of reading and sending signals to and from other external equipment through its standard TTL port. This powerful capability allows the controller to process data and make decisions based on other external sources such as pressure switches, line scan cameras, and relays.

The ProScan controller has a 10 way boxed header (male). Four pins are assigned to TTL output (one Byte) from the Controller and Four pins to TTL inputs (one Byte).

The matching female part to be used with this header is an Industry standard ribbon cable socket with centre bump polarisation (to ensure correct orientation) manufactured by 3M (part number 3421-6620), Thomas and Betts (part number 609 2041) etc.

The TTL outputs use a 74HCT374 buffer IC and the TTL inputs input to a 74HCT541

+5 Volts is available from pins 1 and 2 (shorted together to share the current) for TTL power to a limited amount of circuitry. Maximum current 100mA.

0V is the zero volts of the electronics inside the controller, which is also chassis ground.

K2 Pin allocation

Pin number	**Signal**
1	+5V_OUT
2	0v (Ground)
3	TTL_OUT 0
4	TTL_OUT 1
5	TTL_OUT 2
6	TTL_OUT 3
7	TTL_IN 0
8	TTL_IN 1
9	TTL_IN 2
10	TTL_IN 3

5.16 TTL Command set

Command	Arguments	Response
TTL	Writes to TTL port. DCBA where DCBA are Hexadecimal numbers assigned as follows:- A TTL_OUT least significant 4 bits B TTL_OUT most significant 4 bits C TTL_IN least significant 4 bits D TTL_IN most significant 4 bits Since TTL_IN are inputs to the controller only i.e. cannot be written to, C and D should both be 0 (any other value is ignored) Acceptable formats are TTL,000E writes TTL high to all 4 TTL_OUT bits except TTL_OUT 0 TTL,E (as above)	0<cr> H129 had 8 TTL IN/OUT bits H130 only has 4 TTL IN/OUT bits (B and D are ignored)
TTL	None	DCBA BA is actual status of 4 Write Bits DC is TTL levels of 4 Input bits. (leading zeros may be omitted)
TTL	n,m Where n is number 0 to 3 and is the data bit number of TTL_OUT (see table above) m is 0 or 1 and sets the level of TTL_OUT m=0 is TTL low m=1 is TTL high. Note that it is important not to omit m or it will be assumed by the controller that n is a Hexadecimal number.	

Command	Arguments	Response
TTL	n,? where n is the data bit number of the TTL TTL_OUT has n between 0 and 3 TTL_IN has n between 8 and 11 (See Hexadecimal nomenclature above)	Returns m the TTL status of bit n m=0 is TTL low m=1 is TTL high for backwards compatibility with H129

5.17 TTL Programming Advanced Features

More complex features are available that provide the user with the ability to construct lists of actions to be executed when TTL input lines change state. There is one list per TTL input. Each list contains one or more trigger points and each trigger point has associated with it one or more actions. A trigger can be activated by a rising or falling edge of the TTL input.

Command	Arguments	Response	Description
TTLTP	n,m where n = TTL input 1,2,3 or 4 where m = 0 falling edge or low m = 1 rising edge or high	0	Adds a trigger point to the TTL input n, activated by a change in the level m
TTLACT	n,action,data1,data2,data3	0	Add an action to the current trigger point for the TTL input n. See table following for full list of actions.
TTLDEL	n where n = TTL input 1,2,3 or 4	0	Deletes all the trigger points and actions associated with TTL input n
TTLRES	n where n = TTL input 1,2,3 or 4	0	Resets the Trigger list for input n back to the start.
TTLTRG	M where m = 0 Disarmed, 1 Armed	0	Arms the global trigger flag
TTLMOT	n,m where n = TTL output 1,2,3 or 4 where m = 0 low, 1 high	0	Changes output n to level m while stage is moving. When n=0 function disabled (default)

Table of Actions:

Description	action	data1	data 2	data 3
Filter 1 Move	1	Filter pos	0	0
Filter 1 next	2	0	0	0
Filter 1 previous	3	0	0	0
Filter 1 Home	4	0	0	0
Filter 2 Move	5	Filter pos	0	0
Filter 2 next	6	0	0	0
Filter 2 previous	7	0	0	0
Filter 2 Home	8	0	0	0
Move Filter 3	9	Filter pos	0	0
Filter 3 next	10	0	0	0
Filter 3 previous	11	0	0	0
Filter 3 Home	12	0	0	0
Lumen Light Level	20	0-100	0	0
Move Z Relative	30	Z pos	0	0
Move Z Absolute	31	Z pos	0	0
Move XY Relative	40	X pos	Y pos	0
Move XY Absolute	41	X pos	Y pos	0
Move XYZ Relative	50	X pos	Y pos	Z pos
Move XYZ Absolute	51	X pos	Y pos	Z pos
Open Shutter 1	60	0	0	0
Close Shutter 1	61	0	0	0
Open Shutter 2	62	0	0	0
Close Shutter 2	63	0	0	0
Open Shutter 3	64	0	0	0
Close Shutter 3	65	0	0	0
Stop All Movement	70	0	0	0

Example 1:

Create a Trigger that will be activated when TTL1 goes low and moves the stage and then open shutter1 on the next rising edge of that input.

TTLTP,1,0	Adds trigger point on TTL 1 on falling edge.
TTLACT,1,40,5000,4000,0	Adds stage movement to current trigger point on TTL 1.
TTLTP,1,1	Adds a new trigger point TTL 1 on rising edge.
TTLACT,1,60,0,0,0	Add open shutter to current trigger point on TTL 1.

TTLTRG,1 Sets system ready.

First falling edge detected will execute the stage command, the next rising edge of TTL1 causes the shutter to open.

Example 2:

The opening of the shutter can be automated by wiring the output of the TTLMOT to another TTL input.

TTLTP,1,0	Adds trigger point on TTL 1 on falling edge.
TTLACT,1,40,5000,4000,0	Adds stage movement to current trigger point on
TTL 1. TTLTP,2,1	Adds new trigger point on TTL 2 rising edge
TTLACT,2,60,0,0,0	Add open shutter to current trigger point on TTL 2.
TTLMOT,2,1	Set the TTL output on TTL 2 to high when stage moving

TTLTRG,1 Set system ready.

5.18 Advanced HID-USB.

Using the following commands the USB communications for the ProScan III can be setup to function as a HID device in windows. The controller will remain in this mode on power cycle.

Contact your local Prior sales office to get ProScan Units delivered with this feature activated.

Command	Arguments	Response	Description
USBHID	none	n	n=0 USB in virtual com mode, n=1 USB in hid mode
USBHID	n	0	n=1 sets USB in hid mode, the controller must be power cycled to enable this feature. n=0 sets USB in virtual com mode, the controller must be power cycled to enable this feature.

Section 6 Glossary of Terms

6.1 Glossary of Terms

Aperture - The area which is available for the passage of light
Autofocus - The ability of a Z focus system to automatically find the correct focus when initiated by either an RS-232 command or the fire button on a joystick.
Autofocus Score - The relative number that represents the contrast for the best image the Autofocus routine has captured.
Autofocus Range - A number from zero to five that represents the relative distance the Z focus drive will travel when trying to maximize the Autofocus Score
Closed Loop Control - A control system whereby the controller adjusts the motor position based on the measurement provided by an electronic linear scale or rotary encoder
Coarse Focus Knob - The large knob on the side of a microscope that moves the stage up and down large distances with relatively small motion.
Compatibility Mode - The serial communication status which allows the H130 Controller to be backwards compatible with the H127 and H128 controllers. See the "COMP" command. Compatibility mode is "COMP,1".
Controller - The device which provides positional control to the stage, focus drive, filter wheel, or shutter.
Digipot - A circular device/encoder, typically mounted on a joystick used to manually rotate the fine focus knob. The digipot rotates the focus knob at an angle relative to the angular movement of the rotation of the digipot.
Encoder - A feedback device which provides positional information for either an XY stage or the focus drive assembly. Encoders can either be rotary or linear.
Encoder Feedback - The signal given from an encoder. This signal can be displayed as in an open loop encoder system or fed back through the controller to provide closed loop control.
Filter - A device typically made of glass or plastic and mounted in a filter wheel that is used to alter the properties of light emitted from a microscope's light source.
Filter Wheel - A motorized turret that holds and positions optical filters in the light path of a microscope
Fine Focus Knob - The small knob on the side of the microscope that moves the stage up and down small amounts with relatively large movements. Typically 100 microns per revolution of the fine focus knob.
Flash Memory Capability - The ability of the Prior H130 controller to download new software without requiring an EPROM change. This ability is analogous to that of a solid state hard drive.
Focus Drive - A motor and adapter assembly that typically mounts to the coarse focus knob of a microscope and drives the fine focus knob.
Hyperterminal - A terminal emulation program provided with Windows Operating Systems. Instructions for setting up Hyperterminal to communicate with the Prior controller are located in the appendices.

Imaging Packages - The general class of computer software including stereology and image analysis which utilize motorized stages and/or focus drives.
Incident Illumination - Light which falls on the object from any direction (typically refers to reflected light applications).
Inverted Microscope - A microscope that views the object from below. The objectives are underneath the stage.
Joystick - A device which allows manual movement of a motorized stage and focus without using RS232 commands.
Legacy Commands - The set of RS232 commands that are common between the H127, H128 and H130 Prior Motor Controllers. See also compatibility commands.
Linear Scales-See Encoders
MACRO - A set of commands that can be entered and started in a block by the use of the MACRO command.
Mechanical Stage - The manually operated X,Y positioning table that comes as standard with most microscopes.
Motorized Stage - An XY positioning table, typically mounted on a microscope that is moved via stepper or servo motors and their corresponding controller.
Open Frame Stage - A stage that allows for transmitted illumination via holes in the X and Y plates.
Open Loop System - A control system that has no means of comparing the output with the input for control purposes. Open loop stage systems rely on the controller to send the proper amount of pulses to the motor to achieve the required movement.
Plug & Play Facility - The ability of the Prior Scientific controller to recognize which components/accessories are connected and to auto-configure itself to work when powered up.
Raster Pattern - A programmed movement where the stage moves a set number of steps across a sample in the X axis and then moves back to its starting position before moving in the Y axis.
RS-232 - A communication standard which specifies electrical, mechanical and functional characteristics for serial binary communication circuits in a point to point link. Commands from a computer's COM port travel to the controller via RS-232.
Serial Control - A type of information transfer where the bits are handled sequentially
Servo Motor - A motor that rotates due to the interaction of the stator field and armature field. Servo motors require feedback loops, i.e. encoders.
Shutter - A device which can be opened or closed to enable or prevent the passage of light between an illumination device and the microscope or between the microscope and a detector such as a camera.
Snake Pattern - A programmed movement where the stage moves a set number of steps across in the X axis and then moves in the Y axis. The stage then moves back to its original X position. This movement is repeated until the complete area of interest has been scanned, creating a snake-like pattern across the sample.
SOAK command - A set of commands which can be entered and started in a block. These commands will be continuously performed in a loop until the "i" or "k" command is entered or the power is cycled.

Solid Frame Stage - A stage where there is no path for transmitted illumination. i.e. the stage plates are solid without holes in them.
Stage Travel - The overall length in X and Y that a stage can move. Standard Commands - The set of commands in the Prior Scientific H130 which the controller is allowed to queue. These commands are enabled by the "Comp,0" command.
Step Size - The movement in microns initiated by either the L,R,F,B,U or D command. This is also the movement of 1 pulse or the minimum stage movement.
Stepper Motor - A motor which when current is applied generates a holding torque. The motor is rotated by switching the coils on and off. The stepper motors in Prior stages and focus motors generally have 200 steps per revolution, which is then micro-stepped to 50,000 micro-steps per revolution.
TTL – Transistor to Transistor Logic. An integrated circuit with its inputs and outputs directly tied to transistors. Inputs and outputs are low voltage (<1 VDC) and high voltage (>3 VDC).
Transmitted Illumination - Light which passes through the object.
Upright Microscope - A microscope that views the object from above.
X-Theta Stage - A stage with motion in both the X direction and Rotational or Theta Direction.
XYZ - The term used to describe the axes of a microscope that move left/right(X), front/back(Y) and up/down(Z).

Section 7 Replacement Parts

7.1 List of Replacement Parts

Part Number Description

W507 Fuse: fuse rating: V250T2A
H101 and H117 and ES111 stage Sample holders
H649 Holder for a single 1", 1.25" and 1.5" Mounted Metallurgical Specimen
H659 Holder for one Mounted Metallurgical Specimen, 1.5" diameter
H658 Holder for six Mounted Metallurgical Specimens, 1.25" diameter
H657 Holder for one Mounted Metallurgical Specimen, 2" diameter
H656 Holder for one Mounted Metallurgical Specimen, 1.25" diameter
H236 Chambered Coverslip Holder. Holds four Lab-Tek Slides with 1,2,4 or 8 chambers
H23X Flask Holder (please specify size of flask)
H223RT Recessed Terasaki Plate Holder (55 x 80mm)
H229D35T Triple Petri Dish Holder for three 35mm diameter Dishes
H229D35D Dual Petri Dish Holder for two 35mm diameter Dishes
H229XR Petri Dish Holder, Universal up to dishes of 100mm diameter.
H223XR Recessed Microtitre Plate Holder (85 x 128mm)
H240 Motorised Rotating Holder, 71mm diameter (additional axis required)
H220 Glass Plate (not suitable for transmitted light microscopy)
H224LP Slide Holder for one 76 x 26mm Microscope Slide
H224XRLP Slide Holder, recessed, for one 76 x 26mm Microscope Slide
H224PLP Slide Holder, recessed, for one 76 x 26mm Microscope Slide
H224ROT Manual Rotating Holder for one 76 x 26mm Microscope Slide

H138 Sample Holders
H230 Aluminium Plate
H234LP Slide Holder for four 76 x 26mm Microscope Slides
H234RLP Slide Holder, recessed, for four 76 x 26mm Microscope Slides
H288 Glass Plate (not suitable for transmitted light microscopy)
H238 Slide Holder for eight 76 x 26mm Microscope Slides
H239 Aluminium Plate
H226 Slide Holder for one 76 x 26mm Microscope Slide
H227 Glass Plate (not suitable for transmitted light microscopy)
H105 Sample Holders
H231 Aluminium Plate
H143 Wafer Chuck, spring loaded for 75mm wafers
H146 Wafer Chuck, spring loaded for 150mm wafers
HWC15S Wafer Chuck, rotatable with steps for 100mm and 150mm wafers

HWC15V	Wafer Chuck, rotatable with vacuum for 150mm wafers
HWC105	Wafer Chuck Pod with vacuum
H246	Motorized Rotating Holder, 150mm diameter (requires four axis controller)
H356	Motorized Shuttle Insert for automatic wafer loaders (100 & 150mm wafers)
H353	Motorized Shuttle Insert for automatic wafer loaders (75mm wafers)
H225	Glass Plate (not suitable for transmitted light microscopy)

H116 sample Holders

H232	Aluminium Plate
H148	Wafer Chuck, spring loaded for 150mm wafers
H149	Wafer Chuck, spring loaded for 200mm wafers
H149N	Wafer Chuck, spring loaded for 200mm notched wafers
HWC20S	Wafer Chuck, rotatable with steps for 150mm & 200mm wafers
HWC20V	Wafer Chuck, rotatable with vacuum for 200mm wafers
HWC116	Wafer Chuck Pod with vacuum

H112 Sample Holders

H233	Aluminium Plate
H221	Glass Plate (not suitable for transmitted light microscopy)
HWC30S	Wafer Chuck, rotatable with steps for 200mm & 300mm wafers
HWC30V	Wafer Chuck, rotatable with vacuum for 300mm wafers
HWC112	Wafer Chuck Pod with vacuum

Accessories

H122	Focus Drive and Adapter
H122E	Focus Drive and Adaptor with Rotary Encoder
H122AX2	Focus Drive, Complete for Zeiss AxioSkop 2, AxioPlan 2 imaging/ie
H122AXIO	Focus Drive and Adapter for Zeiss AxioSkop, AxioPlan, AxioPlan 2 & AxioVert 100
H122AXIE	Focus Drive and Adapter (encoded)for Zeiss AxioSkop, AxioPlan, AxioPlan 2 & AxioVert 100
H122X200	Focus Drive and Adapter for AxioVert 200 with Encoders
HF110	Filter Wheel (25mm Filters)
HF108	Filter Wheel (32mm Filters) HF200 Shutter for use with 25mm Filter Wheel (to be mounted to filter wheel)
HF201	Shutter for use with 32mm Filter Wheel (to be mounted to filter wheel)
HF202	Shutter, 25mm aperture (stand alone)
HF204	Shutter, 32mm aperture (stand alone)
H276K	RS232 cable for PC (9 or 25 pin) H277 RS232 cable for Macintosh

H122KON	Solid Couple Adapter for Focus Drive on Olympus/Nikon
H122KLC	Solid Couple Adapter for Focus Drive on Leica
HF207	Male to Male C mount adapter
HF210	Filter Wheel Adapter for Leica pre DM Series
HF215	Filter Wheel Adapter for Leica DM Series
H F220	Filter Wheel Adapter for Nikon Eclipse Series
HF230	Filter Wheel Adapter for Olympus BH Series
HF235	Filter Wheel Adapter for Olympus BX, IX and AX Series HF240 Filter Wheel Adapter for Zeiss Axio Series
HF245	Filter Wheel Adapter for Zeiss pre Axio Series
HF205	Dual Slide in Filter Holder for Filter Wheels
HF535	Mounting Plate (Converts HF115 into HF110)
HF559	Cover Plate (Converts HF200 into HF202)
HF568	Cover Plate (Converts HF201 into HF204) HF310 Filter Wheel Stand

Section 8 Returns and Repairs

8.1 Returns and Repairs

Should you experience problems with your ProScan System and want to send it back for service, warranty or otherwise, a Return Material Authorisation (RMA) number must be obtained from the appropriate Prior Scientific office before returning any equipment. For North and South America contact Prior Scientific Inc. and for the rest of the world call Prior Scientific Instruments Limited on the telephone numbers shown below.

Prior Scientific Instruments Ltd
Unit 4,
Wilbraham Road,
Fulbourn,
Cambridge,
England,
CB21 5ET
Tel: 01223 881711
Fax: 01223 881710
email: uksales@prior.com

Prior Scientific Inc.
80 Reservoir Park Drive,
Rockland,
MA 02370-1062
USA
Tel: 781 878 8442
Fax: 781 878 8736
email: info@prior.com

Prior Scientific GmbH
Wildenbruchstr. 15
D-07745
JENA
GERMANY
Tel: +49 (0)3641 675 650
Fax: +44 (0)3641 675 651
email: jena@prior.com

Appendices

Appendix A Non Standard Focus Drive Installations

Notice:
This installation should only be attempted by a qualified technician. It involves some minor disassembly of critical mechanical components. If you are not familiar with this type of mechanical assembly do not attempt this installation, consult your local microscope representative.

Introduction
The focus drive is compatible with all of the Zeiss Axio type microscopes listed below. However, it is not compatible with the Zeiss Axiskop 2 and Axioplan 2. The focus drive must be attached to the fine focus ball reduction mechanism as follows:

Axioplan	Left Side	Axiotron 10	Right side	Axiolab	Right side
Axioskop	Left Side	Axiovert 35	Right side	Standard	Right side
Axiovert 25	Left Side	Axiovert 100	Right side	Axiovert 135	Right side

Components
The focus drive assembly is comprised of the following: Drive motor, motor bracket and switch assembly Mounting block Anti backlash gear and locknut Cover and lead Also included are screws and hexagon keys needed to install the focus drive unit.

Tools Required
14mm AF spanner or socket, 1pt Philips screw driver, 1.27mm hexagon key (supplied) 2.5mm hexagon key (supplied) 3.0mm hexagon key (supplied).

Prepare the focus drive

Remove the cover. Remove bag containing anti-backlash gear, locknut and hexagon keys. Using 3.0 hexagon key remove the two 4mm cap head screws that hold the mounting block to the motor bracket assembly.

Installation of the focus drive

Figure 1

Determine which side the focus drive must go (see introduction).

Remove the fine focus knob by using the 1.27mm hexagon key to unscrew the set screw. The knob can then be pulled off.

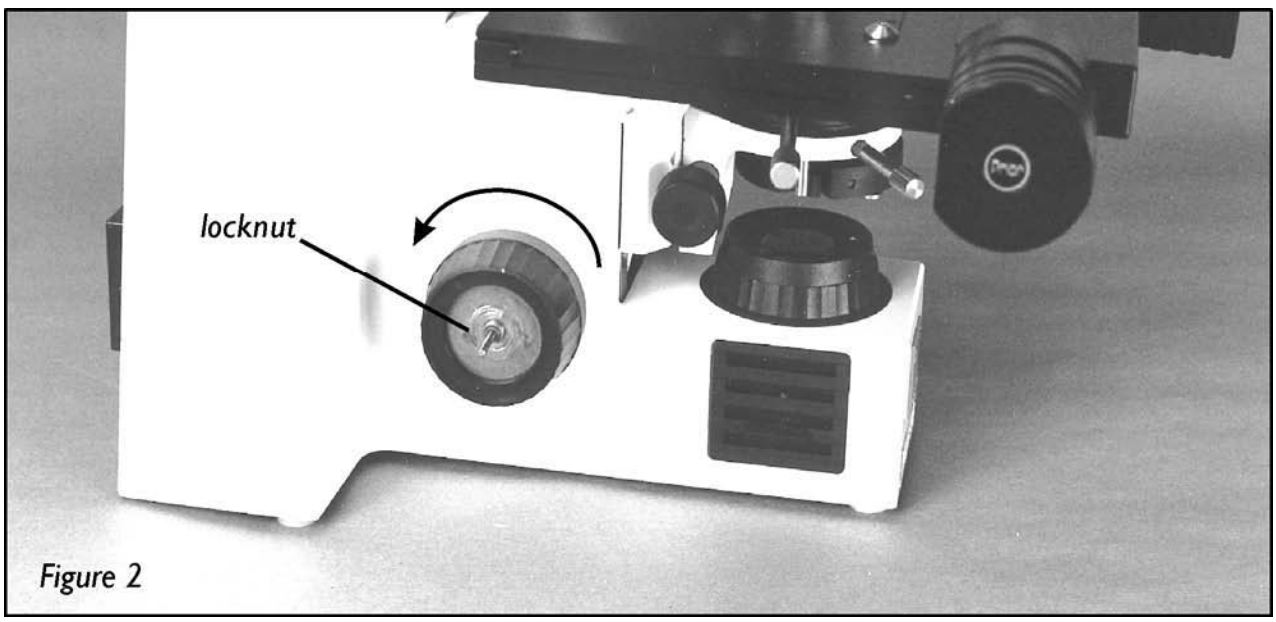


Figure 2

Using the 14mm spanner or socket to remove the lock nut. The coarse knob can now be removed by turning anti-clockwise and unscrewing from the coarse focus shaft. A black plastic cover should now be visible (see fig. 3). If this is not the case, check the introduction to ensure you removed the knobs from the correct side. It is very important that you replace both coarse and fine knobs before removing the knobs on the opposite side.

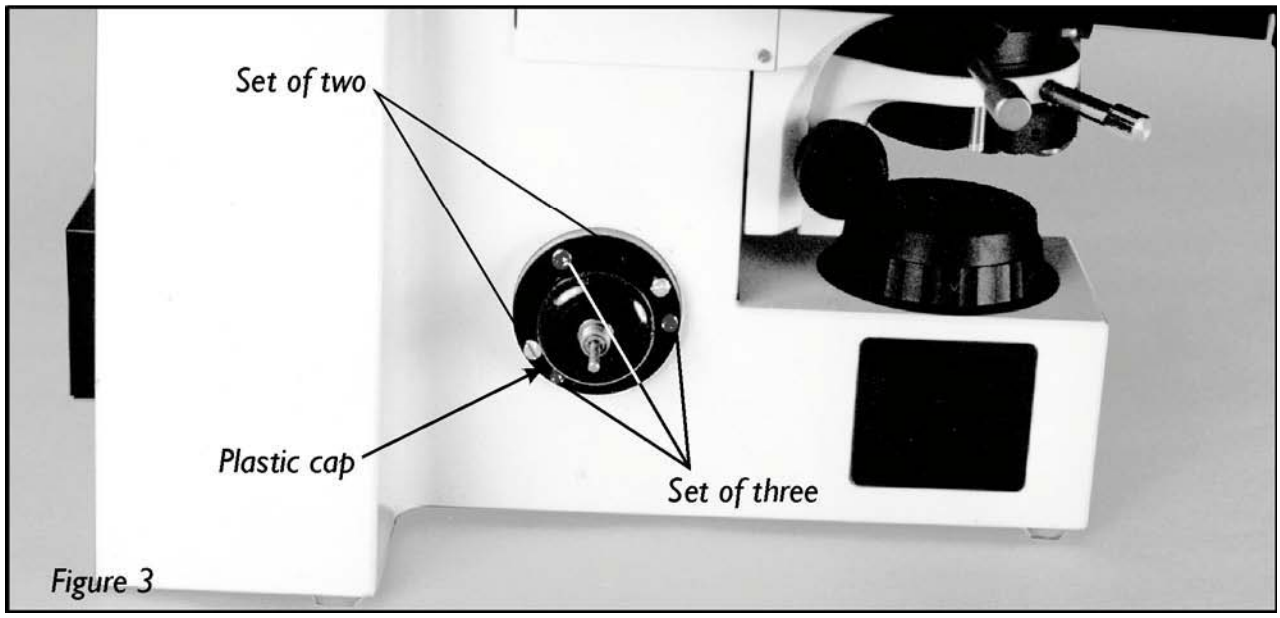


Figure 3

The plastic cap is held on with five screws, one set of two screws and one set of three. If the set of two screws are missing then install the two M3 x 6mm cap head screws supplied. Remove the set of 3 screws using the 2.5mm hexagon key.

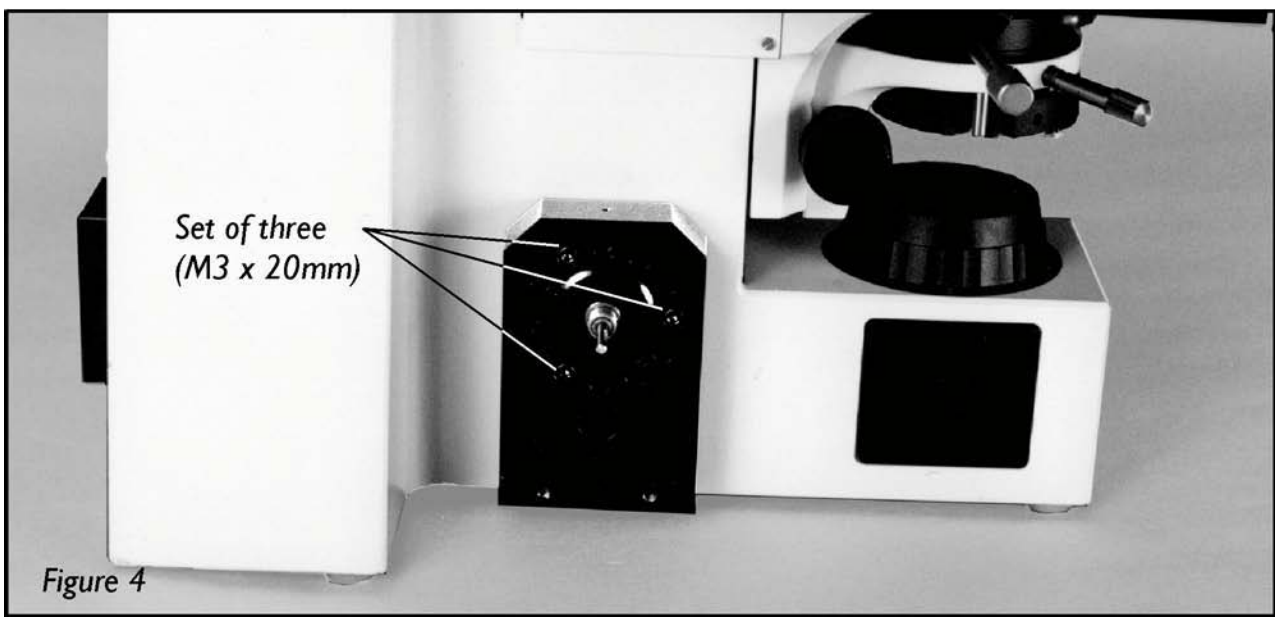


Figure 4

Place the mounting block over the plastic cap and hold in place using the 3 M3 x 20mm cap head screws supplied.

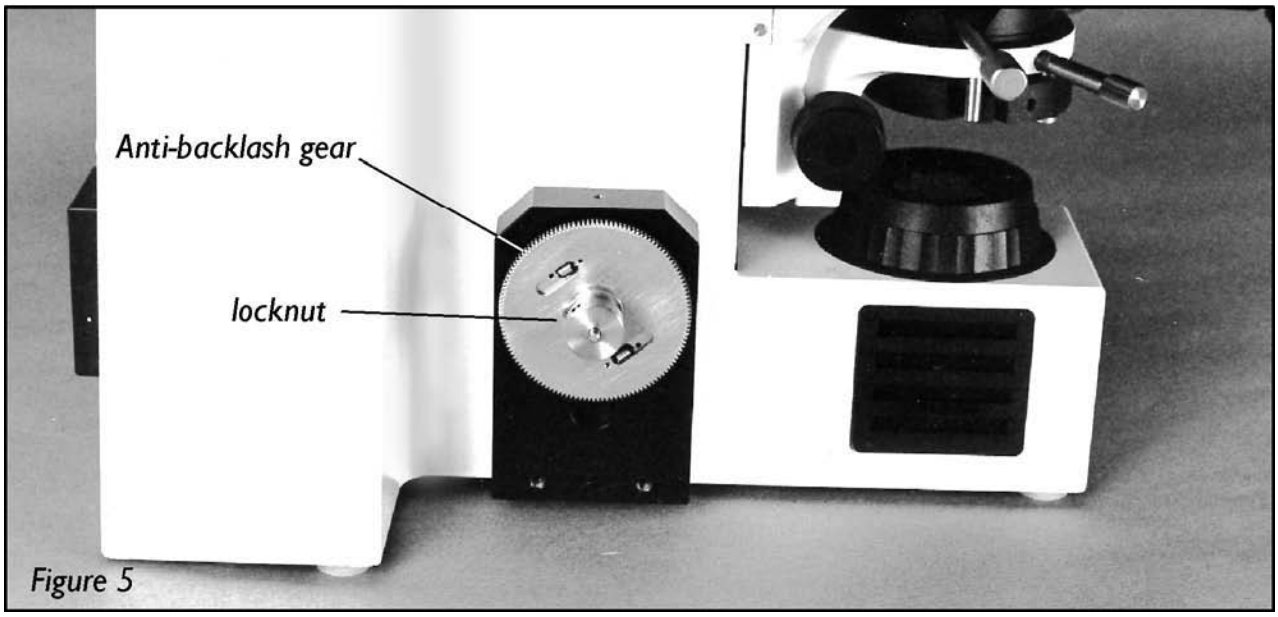


Figure 5

Screw the anti-backlash gear onto the coarse drive shaft, making sure the gear's boss is facing outwards. Screw the locknut into the boss and tighten.

Figure 6

Attach the motor, bracket and switch assembly to the mounting block using the two M4 cap head screws. The anti-backlash gear has two gears, one fixed, the other spring loaded and free to rotate. Rotate this gear approximately 6 teeth before aligning with the motor gear.

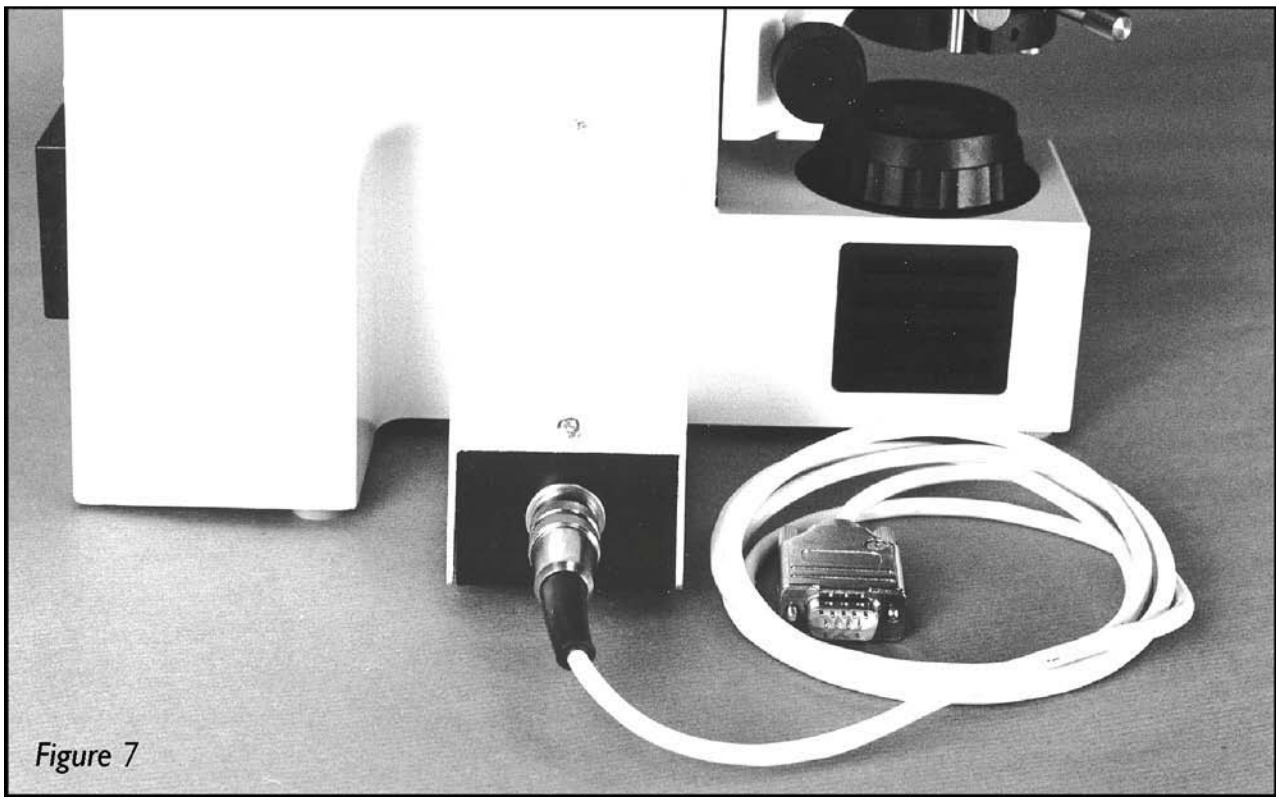


Figure 7

Replace the cover and attach the lead. If the focus drive unit appears to drive in the wrong direction, i.e. you ask the controller to move up and the stage moves down, then the switch is set to the wrong position. Disconnect the power supply to the focus drive, remove the cover, move the switch and then replace the cover. The unit will now move in the correct direction.

Focus drive installation for the Leica DML range

H122LB motorised focus kit parts list

H249 Microstep Focus Motor
H1073 Adapter ring (for Leica DMLB)
H1166 Drive coupling (For Leica DMLB)
H569 Focus motor sleeve
S690 Thumb locking screw
W1401 2mm hexagonal wrench
W347 1.5mm hexagonal wrench

Fitting the H122LB to the Leica DMLB involves removing the right hand fine focus knob. Note that this has two sensitivity settings depending on whether the fine focus mechanism is pushed to the right (4 microns) or pushed to the left (1 micron). This option is indicated by the label on the front surface of the left hand stabiliser. The fine focus must be set at the 1 micron position. Push the fine focus fully to the left. Note the amount of the vernier scale showing on the left hand knob (figure 1). Fitting the H122LB is done with the fine focus in this 1 micron position. Remove the right hand focus knob using the 1.5 mm hexagonal wrench key inserted down the small hole in the right hand fine focus. Hold the left hand fine focus knob when pulling off the right hand fine focus knob ensuring that there is no lateral movement of the shaft. There should be approximatley 13mm shaft length protruding from the brass boss (figure 2). Ensure that the small spring washer is still on the shaft.

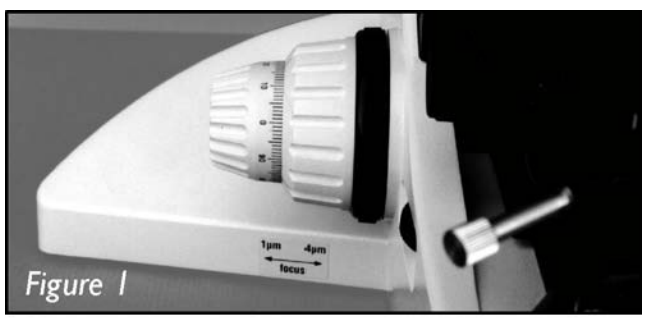


Figure 1

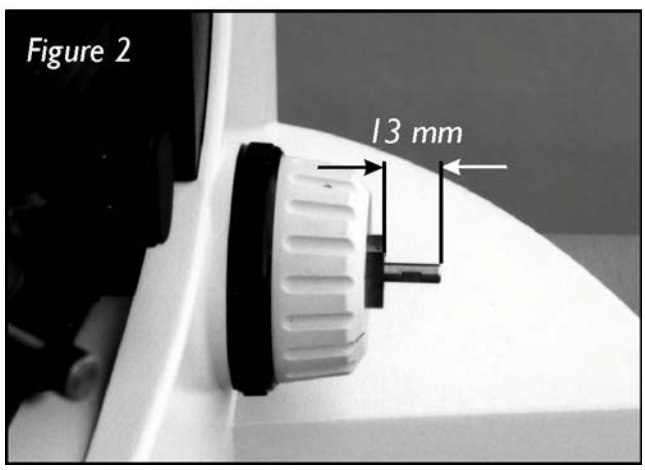


Figure 2

Fit the large adapter ring over the brass boss. Note that the orientation of the adapter ring should be such that the grub screw in the adapter ring screws down onto the centre of the radius (curved part of the brass boss) -(figure 3)

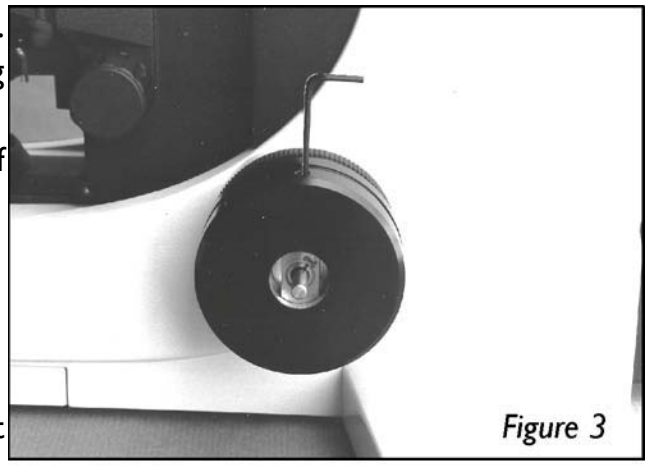


Figure 3

Push this fully towards the body of the microscope leaving approximately 9mm of shaft protruding from the adapter ring whilst tightening up the adapter ring using the 2mm hexagonal wrench key (figure 4).
Fit the drive coupling on the fine focus shaft using the 1.5mm hexagonal wrench key. Orient the shaft so that the grub screw will locate on the flat of the shaft. Push the drive coupling gently towards the adapter ring whilst tightening the grub screw. Check that the fine focus rotates freely and is still set at 1 micron.

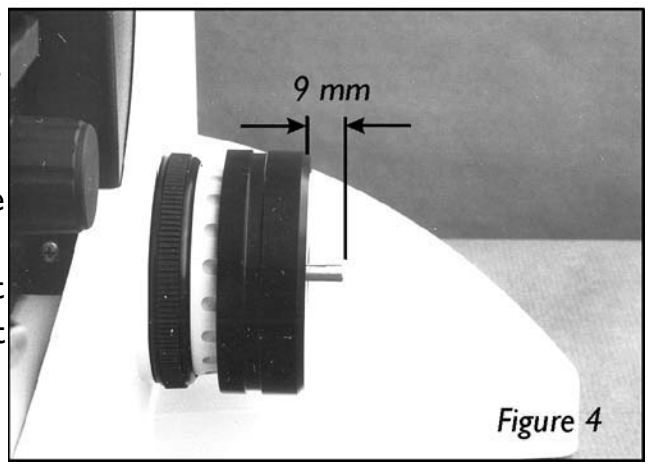


Figure 4

Fit H569 motor sleeve on the adapter ring. Tighten up 3 grub screws in sequence using the 2mm Hexagonal wrench key (figure 5). It may be necessary to rotate the motor sleeve to gain access to each grub screw. The motor sleeve and adapter ring are now attached to the coarse focus. Slide the H249 Microstep Focus motor assembly into the motor sleeve and tighten the S690 thumb screw whilst gently pushing the focus motor assembly towards the microscope such that there is a good contact between the rubber surfaces of the drive of the motor and the drive coupling (figure 5). The fitting is now complete. The motor is now able to drive the fine focus mechanism of the microscope.

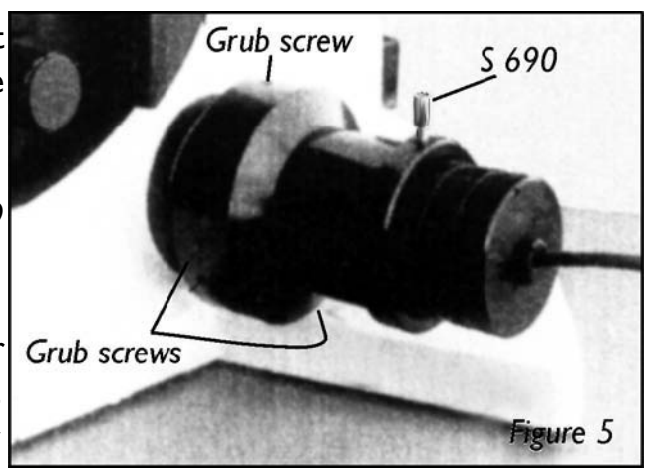


Figure 5

Appendix B Direct Coupling Focus Installation

Direct Coupling Focus Installation for Leica and DML and DMR Range

Notice:
This installation should only be attempted by a qualified technician. It involves some minor disassembly of critical mechanical components. If you are not familiar with this type of mechanical assembly do not attempt this installation, consult your local microscope representative.

Components
Installation on 'DMR'

Step 1 Using a 1.27mm Hexagonal key, undo the fine focus set screw. The knob can then be pulled off.

Step 2

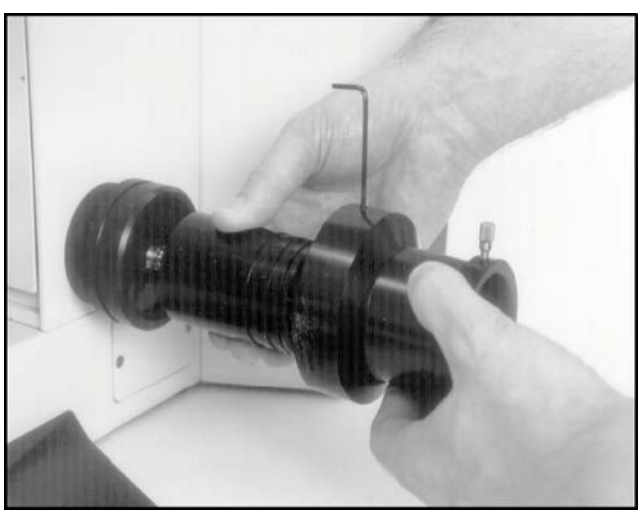
Place the spring over the fine focus shaft and place a coupling hub on the shaft whilst holding the opposite focus knob in position, or it may disengage from gears. Compress the spring by 3-6mm and clamp the hub using the 2mm hexagon key. Note: Only one of the coupling hubs will fit the fine focus shaft.

Push the remaining coupling hub and plastic torque disc together and place on the focus motor shaft. Tighten using the 2mm hexagon key making sure it does not bind on the motor casing.

Step 3

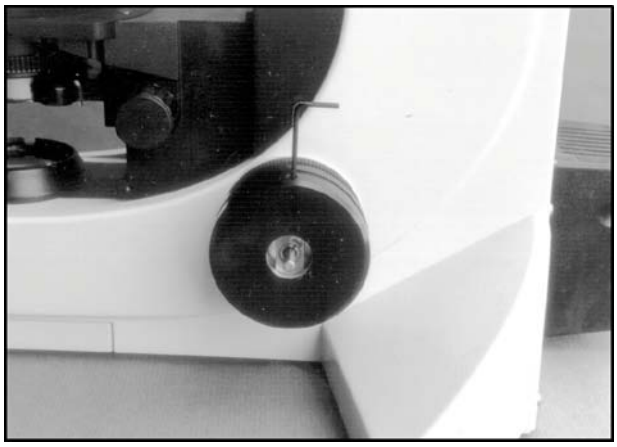
Step 4

Place the adaptor ring over the coarse focus knob. Align and push the couplings together and slide the focus sleeve over the focus motor and onto the adapter ring, using the 2mm hexagon key to tighten the three set screws. Again whilst holding the opposite focus knob.

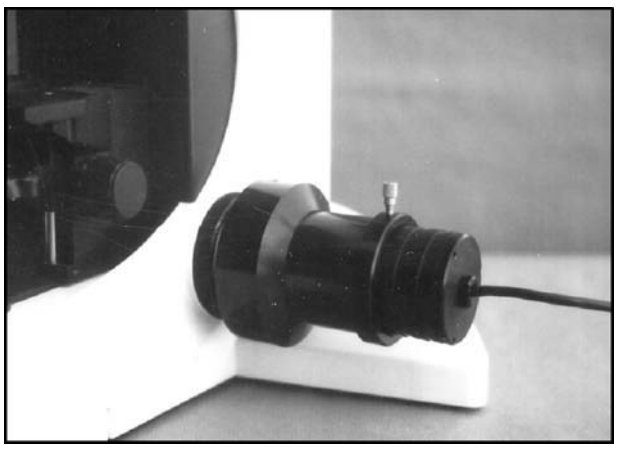


Installation on the 'DML' Series

Step 1



Step 1 as for 'DMR' series - then place the adaptor ring over the coarse focus knob and secure the brass shaft using the 2mm hexagon key on the set screw. Continue with steps 2, 3 and 4 as for 'DMR' series.



Appendix C How to Run HyperTerminal

Instructions for using Windows Terminal Emulation Program (Windows 3.11) for communication to Prior Controller.

Double-click the ACCESSORIES Group symbol in WINDOWS 3.11
Double-click the TERMINAL Icon.
From the SETTINGS menu select COMMUNICATIONS.

Choose: -

Baud Rate	9600
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	None
Connector	Com1 or Com2 depending on which port is required to be used.
Parity Check	Off
Carrier Detect	Off

Press OK button.
From SETTINGS menu select TERMINAL PREFERENCES

Choose: -

Line Wrap	On
Local Echo	On
Sound	Off
cr-cr/lf Inbound	On
cr-cr/lf Outbound	Off
Columns	80
Translations	United Kingdom
IBM to ANSI	Off
Buffer Lines	100

Press OK

From SETTINGS menu select TERMINAL EMULATION

Choose: - DECVT-100 (ANSI)
Choose OK

Select SAVE AS --- from FILE menu and save settings as PRIOR
These settings can be retrieved at any time by selecting it from FILE menu at start of a new session.

Instructions for using Windows HyperTerminal Emulation Program (Windows 95) for communication to Prior Controller.

Click Start, then Programs, then Accessories, then HyperTerminal.
Double-click the "Hypertrm" icon.
Enter filename e.g. prior, select an icon and press OK
Select File, then Properties, then Phone Number
Select COM1 or COM2 as appropriate for the "Connect using..." option.
Press Configure…. Button

Enter the following parameters in the Port Settings box;

Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Press OK button.
Select Settings tab.
Press ASCII Setup...
Select "Echo typed characters locally" and "Append line feeds to incoming line ends"
Press OK.
Press OK.

Instructions for using Windows HyperTerminal Emulation Program (Windows NT) for communication to Prior Controller.

Click Start, then Programs, then Accessories, then HyperTerminal.
Select the "HyperTerminal" icon.
In the "Connection description" dialog box enter filename e.g. prior, select an icon and press OK.
In the "Connect to" dialog box enter Phone Number (if required) and Select COM1 or COM2 as appropriate and press OK.

Enter the following parameters in the Port Settings box ;

Bits per second	9600
Data bits	8
Parity	None
Stop bits	1
Flow control	None

Press OK button.
Select File.
Properties and Settings tab.
Press ASCII Setup...
Select "Echo typed characters locally" and "Append line feeds to incoming line ends" (you should find that "Wrap lines that exceed terminal width" has already been selected).
Press OK
Press OK.

Instructions for using Windows HyperTerminal Emulation Program (Windows Vista) for communication to Prior Controller.

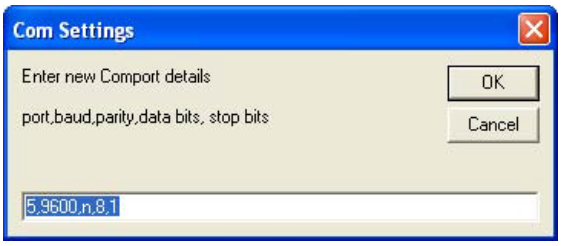
Window Vista does not support HyperTerminal.
Prior have supplied a Vista compatible Terminal application for use under these circumstances.

Download the Terminal Installer from:
http://www.prioruk.com/downloadcentre/dc_software.html

Unzip the downloaded file and run the installer.
Follow the onscreen instructions to install the program.

Running Prior Terminal: Start the program by running
from the start menu: Start>Prior
Scientific>PriorTerminal

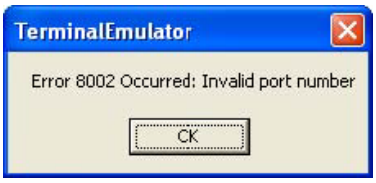
The following screen will be displayed:



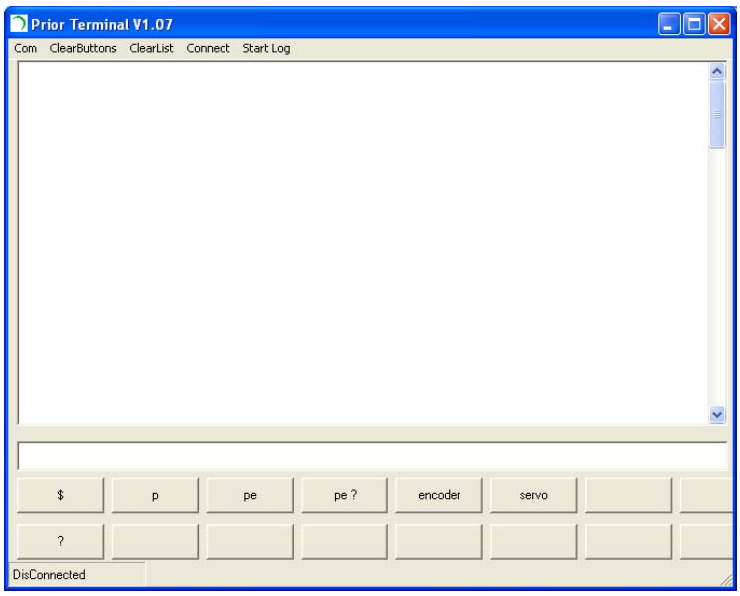
The connection properties should be typed into the window: COM Port Number, Baud Rate, “n,8,1”

Users should only change the COM Port number and Baud Rate the remaining three characters, “n,8,1” should remain the same.

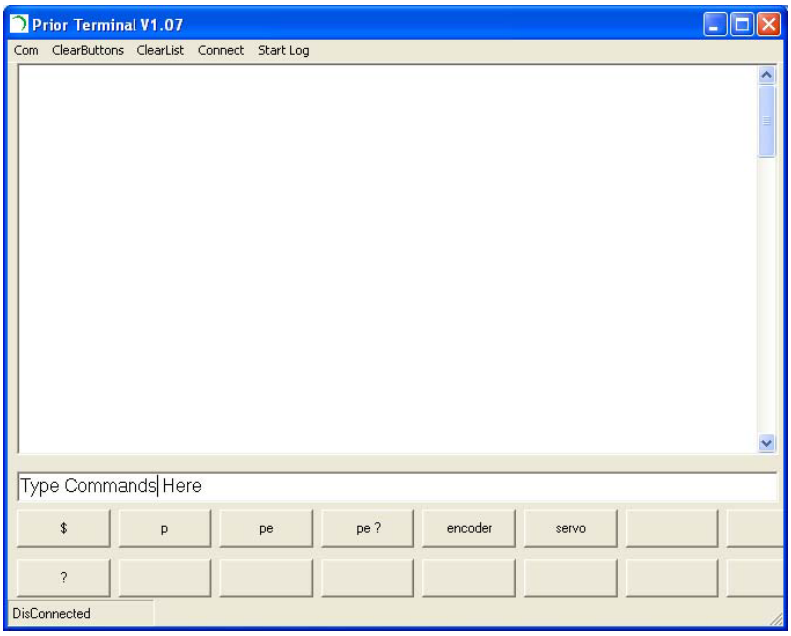
The controller with factory settings will have a Baud Rate of 9600. Other baud rate options are: 19200 and 38400



If the above screen is displayed, select ok and then choose COM from the menu.



Identification of Menus:



COM: Allows the user to change the COM port settings.
ClearButtons: Clears the usage of all buttons.
ClearList: Removes all text from screen.
Connect/Disconnect: Connects and Disconnects to the COM Port selected with the settings provided in the COM menu.
Startlog/Stoplog: Writes all communications to a file "capture.txt" on the desktop. Test will be appended if capture.txt already exists.

Using the program:

Type the command into the line marked "Type Commands Here" and press return on the keyboard to send. The command will be displayed and the response from the controller.

Setting the buttons: Right click with the mouse and type into the window the command to associate with the button.
Click ok.
Using the button:
Left click on the button.

Part Number W3819

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